

TABLE OF CONTENTS

Section

Coordinates

- | | |
|---|------|
| 1. Test specifications | A 2 |
| 2. Terminal diagram for preheating system | A 4 |
| 3. Tools | A 6 |
| 4. Remove fuel-injection pump | A 7 |
| 5. Install fuel-injection pump | A 12 |
| 6. Test injection timing | A 17 |
| 7. Test charge-air pressure | A 22 |



1. Test specifications

1.1 Idle speed: $800 + 50 \text{ min}^{-1}$

1.2 Nozzle-opening pressure: $155 + 8 \text{ bar}$

1.3 Injection timing:

Engine position:

Alfetta, Giulietta 2.0 l, 4-cyl. TD

Cylinder 1 $8^\circ \cong 8 \text{ mm BTDC}$

Alfetta 2.4 l, 4-cyl. TD

Cylinder 1 $5^\circ \cong 5 \text{ mm-BTDC}$

Alfa 6 2.5 l, 5-cyl. TD

Cylinder 1 $6^\circ \cong 6 \text{ mm BTDC}$

Pump position: 0.50 mm ABDC

1.4 Compression pressure: $21 \dots 22 \text{ bar}$

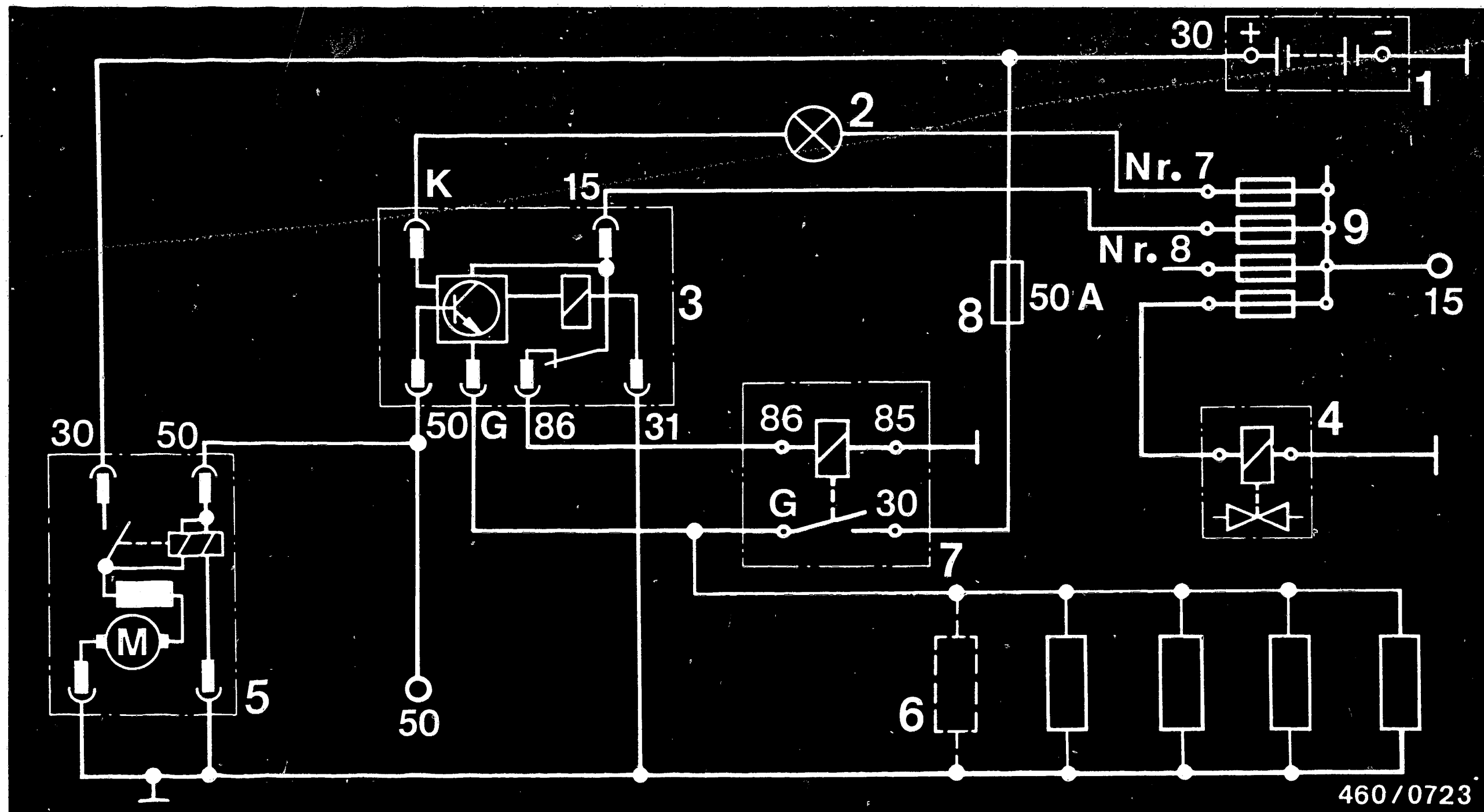
1.5 Charge-air pressure: $0.40 \dots 0.46 \text{ bar}$ at
 4000 min^{-1} without
load
max. 0.9 bar at
 4200 min^{-1} with
load



1.6 Tightening torques

Injection-pump gear	87 Nm
Nozzle-holder assembly	25 ...30 Nm
Fuel lines	15 ...20 Nm
Injection-pump fastening screws	25 Nm
Fuel line inlet-union screws	25 Nm
Screw plug	10 Nm





1 = Battery
2 = Glow-plug indicator lamp
3 = Glow-duration unit

5 = Starting motor
7 = Power relay
8 = Fuse 50 A

4 = Solenoid-operated valve
6 = Glow plugs
9 = Fuse box

2. Terminal diagram for preheating system

A4

Test preheating system
Alfa Romeo Turbo-Diesel



A5

Test preheating system
Alfa Romeo Turbo-Diesel



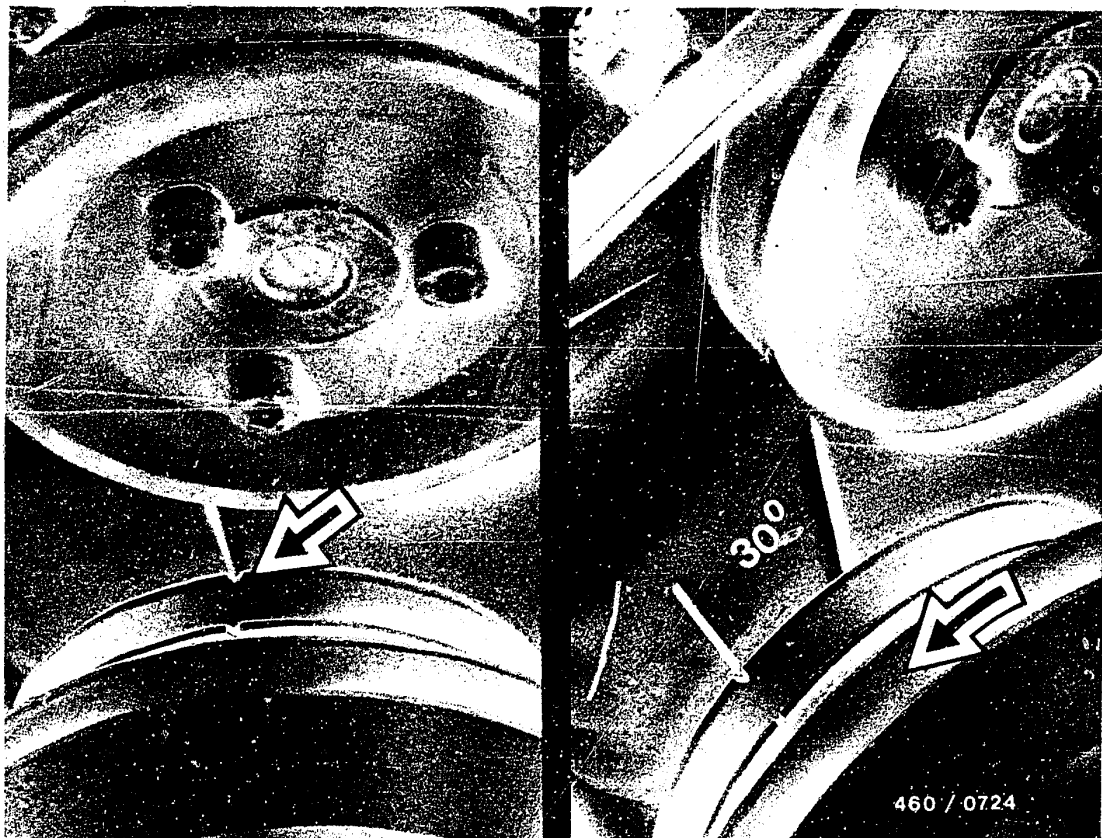
460/0723

3. Test equipment and tools

Holding and press-out device	A 7. 0384 *	Locking injection-pump drive gear
Pressure tester or pressure gauge 0...1.6 bar	KDJE-P 100 e.g. W i k a No. 4 184	Testing the charge-air pressure
Measuring tool	KDEP 1085	Injection timing
Mini dial indicator 1/100 mm graduations	Commercially available e.g. Hahn & Kolb 7000 Stuttgart Part No. 33 033 with adapter KDEP 1127	Injection timing

* Obtainable through Alfa Romeo agent





4. Remove fuel-injection pump

Loosen water hoses on radiator and remove radiator.

Remove cylinder cover...

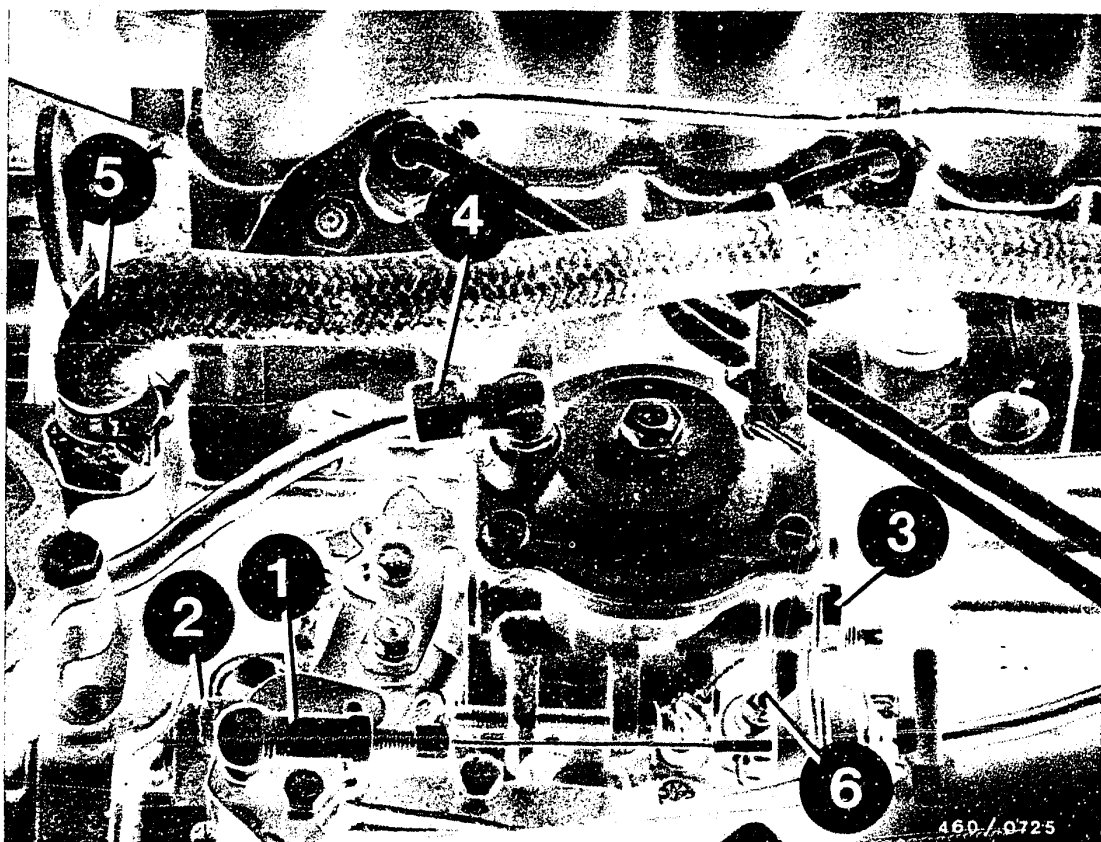
Turn crankshaft to TDC on cylinder 1 (timing gear end).

Mark on timing case must align with pulley mark (Fig. a, arrow).

Turn crankshaft 30° against engine direction of rotation (Fig. b, direction of arrow).

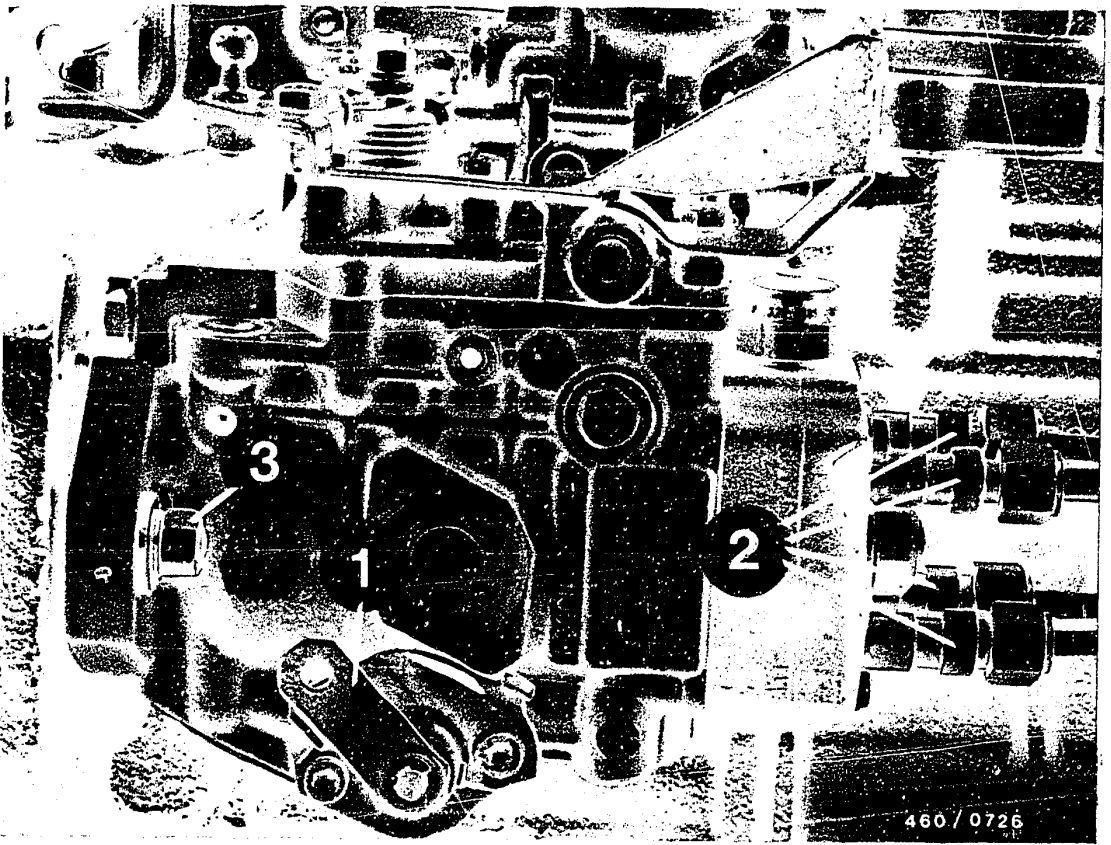
Remove battery.





Remove cable from injection-pump control lever (1), fuel inlet line (2), fuel return line (3), pressure line (4), vacuum line (5) and electrical cable from shutoff solenoid (6).





Remove cable from cold-start accelerator (1) and remove injection lines (2).

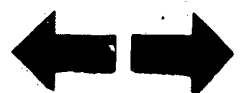
(Prevent delivery-valve holders from coming loose by holding with a wrench)

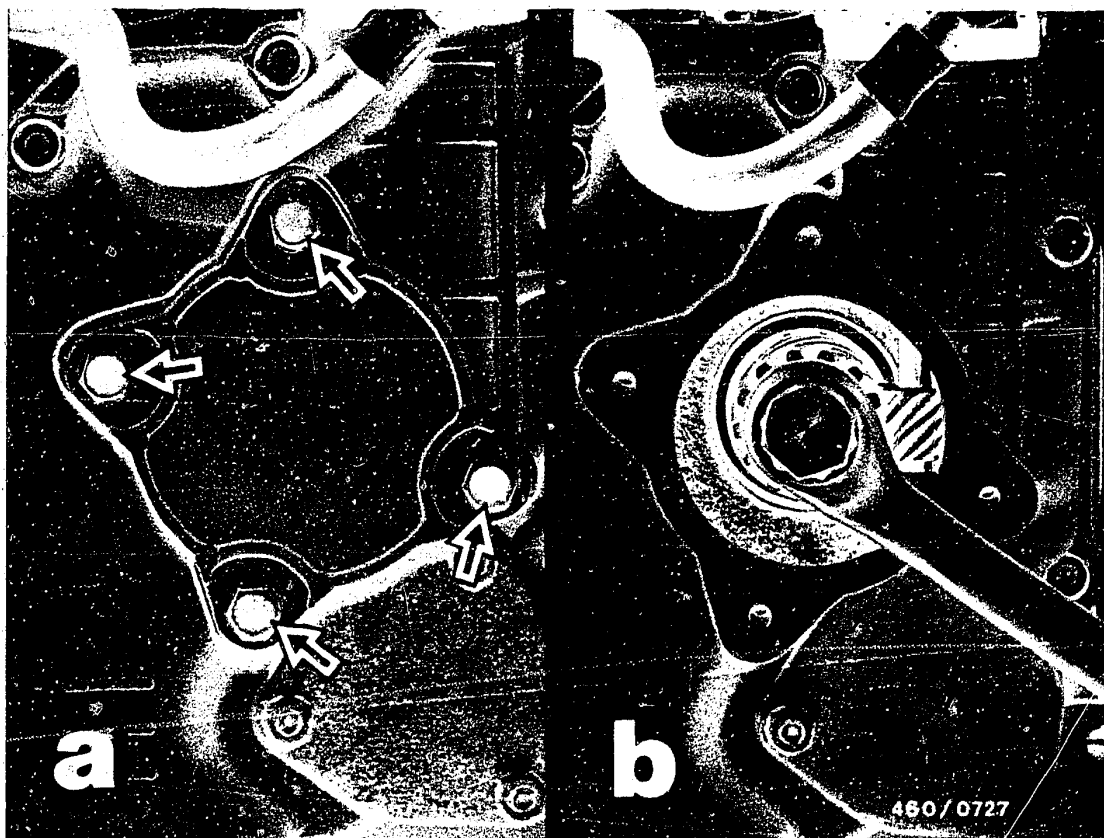
Unscrew fastening nuts (3).

A9

Remove fuel-injection pump

Alfa Romeo Turbo-Diesel





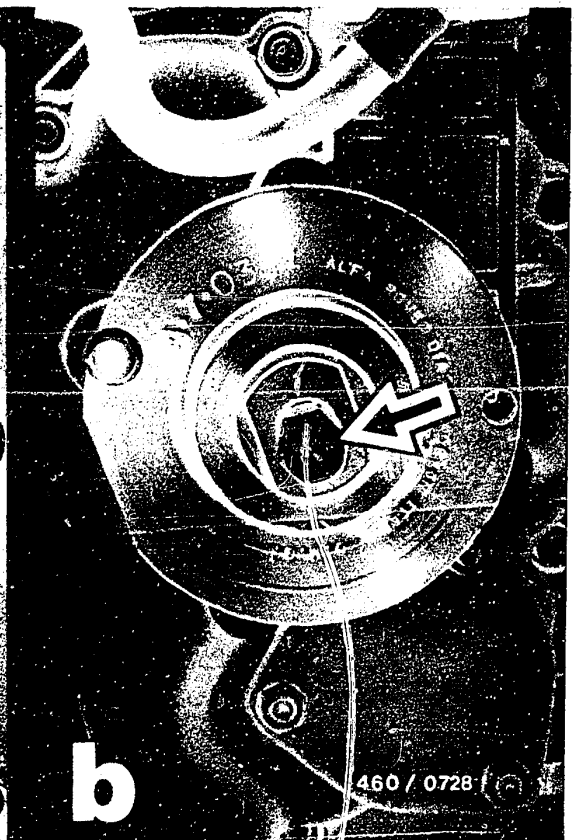
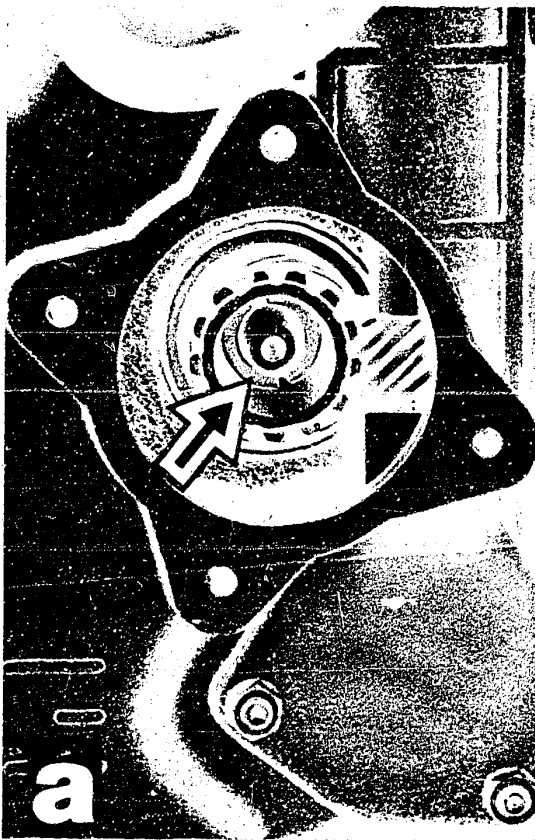
Remove fastening screws (Fig. a, arrow) from injection-pump drive gear closing cover.

Unscrew injection-pump gear fastening screw (Fig. b).

A10

Remove fuel-injection pump
Alfa Romeo Turbo-Diesel





Screw threaded sleeve of holding and press-out device into vacuum pump drive gear (Fig. a, arrow).

Fix device with a screw of the closing cover (Fig. b).

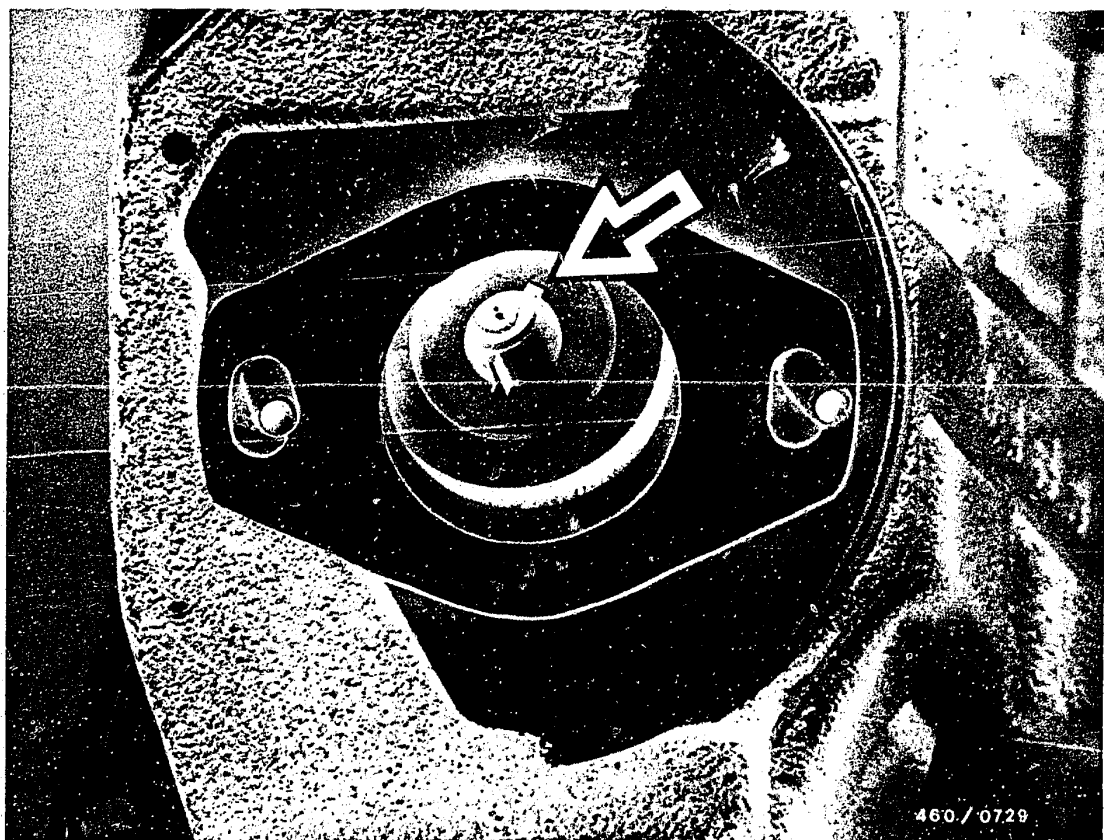
By screwing in the press-out screw (Fig. b, arrow) press injection-pump drive shaft out of drive gear.

Remove injection pump from engine, paying attention to shim ring.

Note:

With the holding device mounted, do not change position of crankshaft.





5. Install fuel-injection pump

Turn injection-pump drive shaft until keyway points toward outlet "A". Install injection pump so that keyway fits into upper keyseat (arrow) of drive gear.

When inserting the injection pump, pay attention to shim ring.

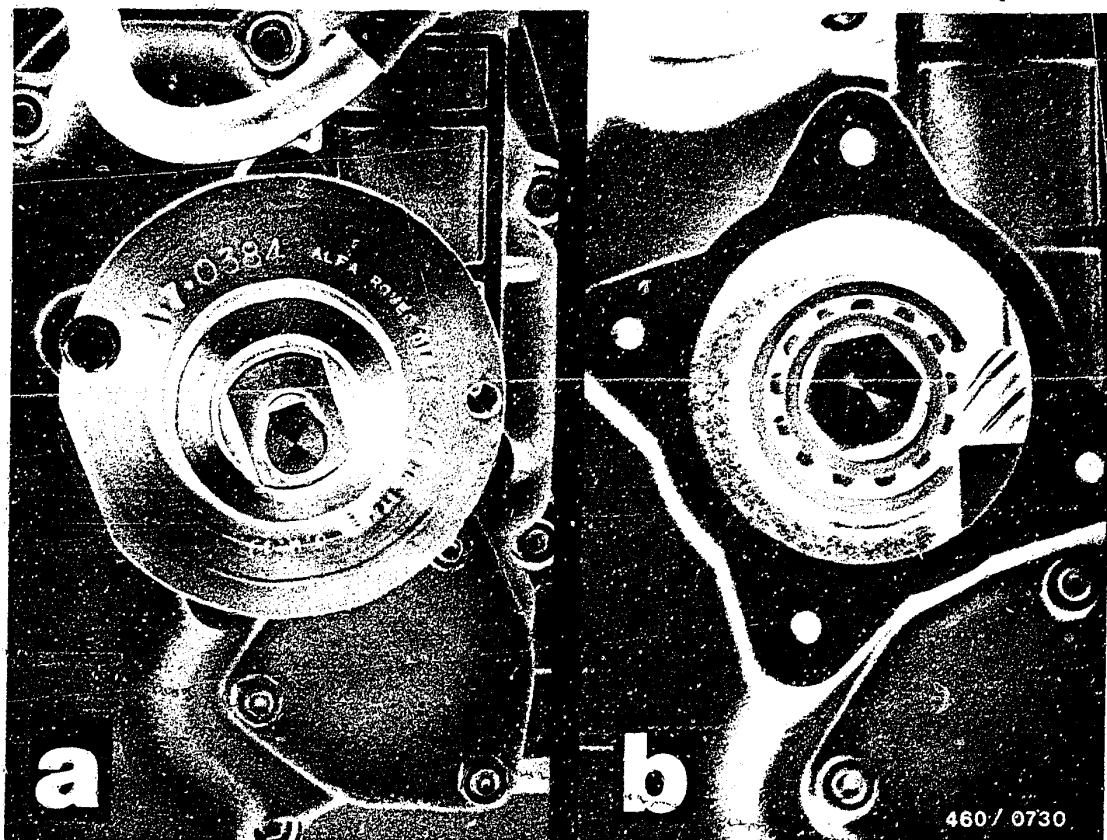
Note on installation

To facilitate installation, position plain washer and spring lock washer of rear stay bolt on pump flange with grease.

Pivot injection pump into center position of slots.

Screw on fastening nuts and finger-tighten.





Remove holding and press-out device (Fig. a).

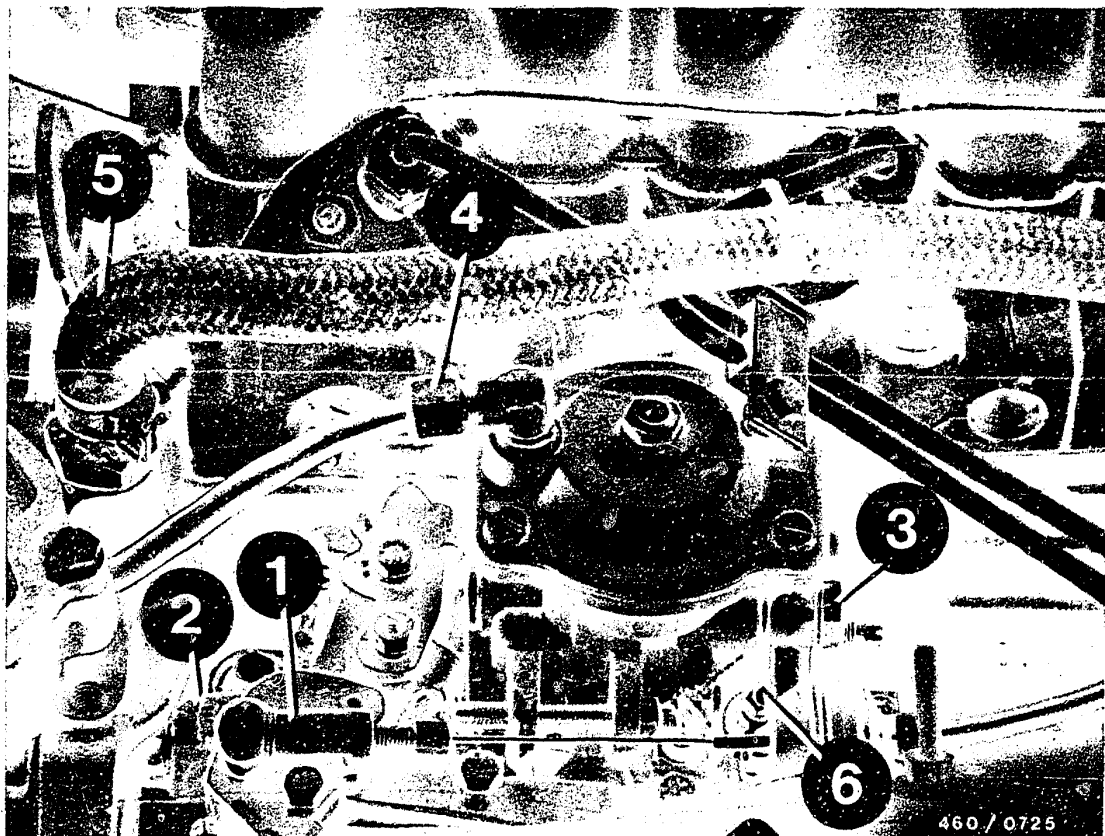
Screw in injection-pump gear fastening screw and tighten to 87 Nm (Fig. b).

Note:

To prevent crankshaft from turning, select gear and pull on handbrake.

Mount closing cover.





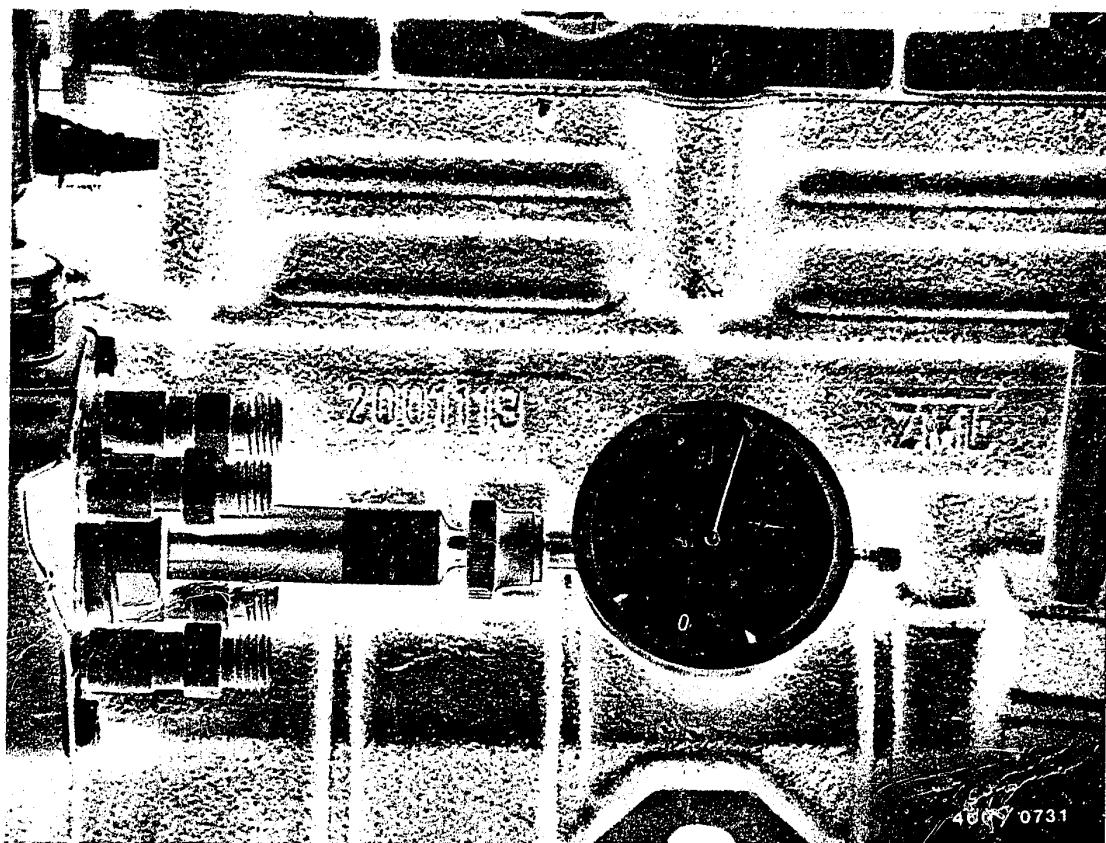
Mount cable on injection-pump control lever (1), fuel inlet line (2), fuel return line (3), pressure line (4), vacuum line (5) and electrical cable on shutoff solenoid (6).

Turn crankshaft in engine direction of rotation until mark on pulley aligns with TDC mark on timing case.

Note:

The inlet-union screws of the fuel inlet and fuel return lines must not be mixed up.

The inlet-union screw of the return is provided with restriction bores and the head of the screw is marked "OUT".



Unscrew bleeder screw out of central screw plug (triangular plug) of hydraulic head.

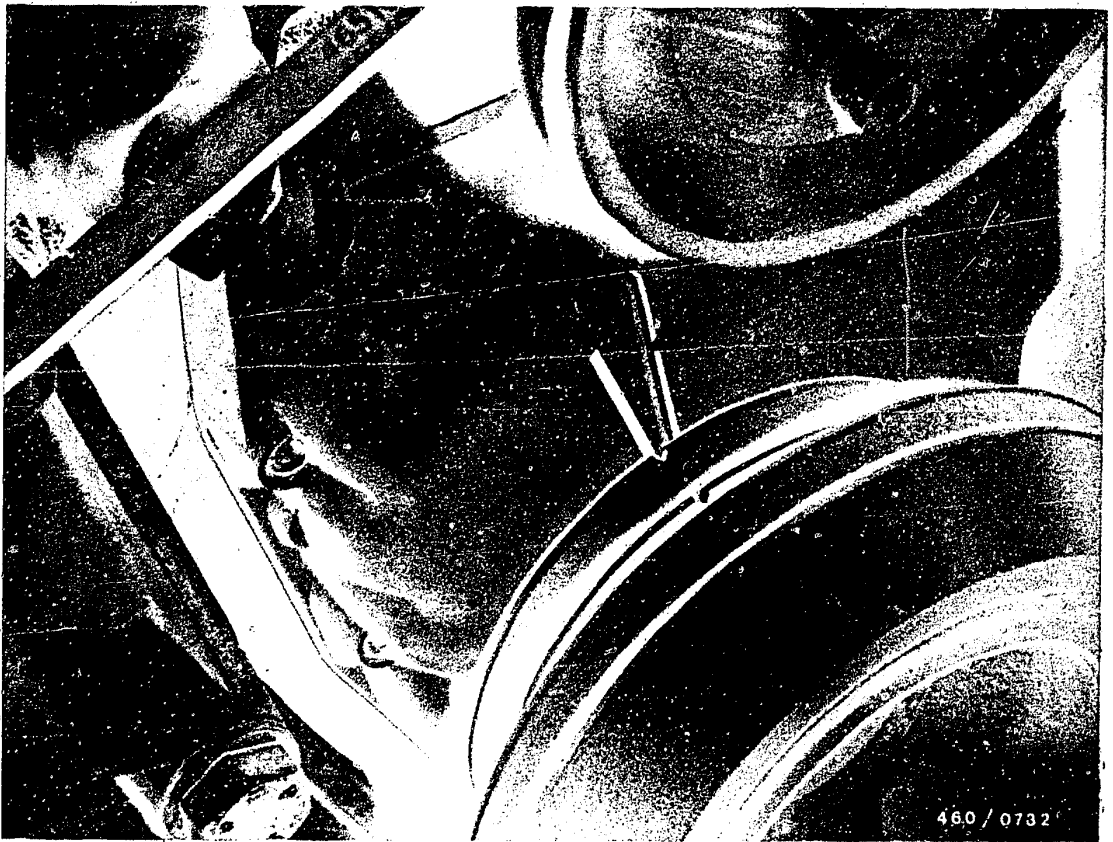
Mount measuring tool KDEP 1085 or 1126 in this bore with dial indicator e.g. 1 687 233 011 and preload by approx. 2 mm.

Turn crankshaft against engine direction of rotation until pointer of dial indicator no longer moves. Set dial indicator to "0".

Note:

When testing and adjusting the start of delivery the cold-start accelerator (KSB) must be in the zero position.





Set crankshaft in engine direction of rotation to the correct value for the vehicle.

Alfetta, Giulietta 2.0 l 4 cylinder TD $8^{\circ} \approx 8$ mm BTDC

Alfetta 2.4 l 4 cylinder TD $5^{\circ} \approx 5$ mm BTDC

Alfa 6 2.5 l 5 cylinder TD $6^{\circ} \approx 6$ mm BTDC

Note:

Remove millimeter indication on circumference of pulley (picture).

In the given crankshaft positions the dial indicator on the injection pump must indicate a plunger stroke of 0.50 mm ABDC.

If necessary, make correction by pivoting the injection pump.

A16

Install fuel-injection pump

Alfa Romeo Turbo-Diesel



Tighten fastening screws to 25 Nm.

Remove measuring tool KDEP 1085 or 1126 with dial indicator.

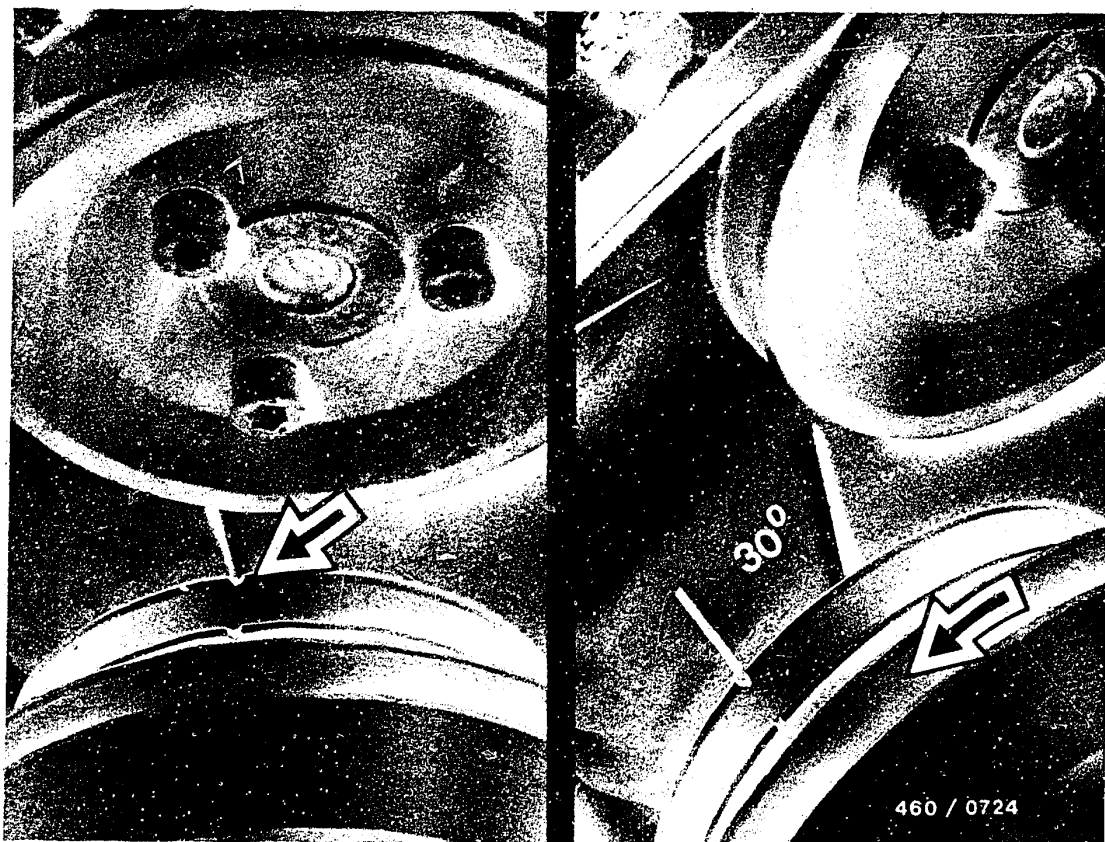
Mount bleeder screw with new seal ring.

Tighten injection lines with box wrench KDEP 1115 (prevent delivery-valve holders from turning by holding with a wrench).

Mount cable on cold-start accelerator and cylinder head cover.

Install battery and radiator.





6. Injection timing

Remove cylinder head cover.

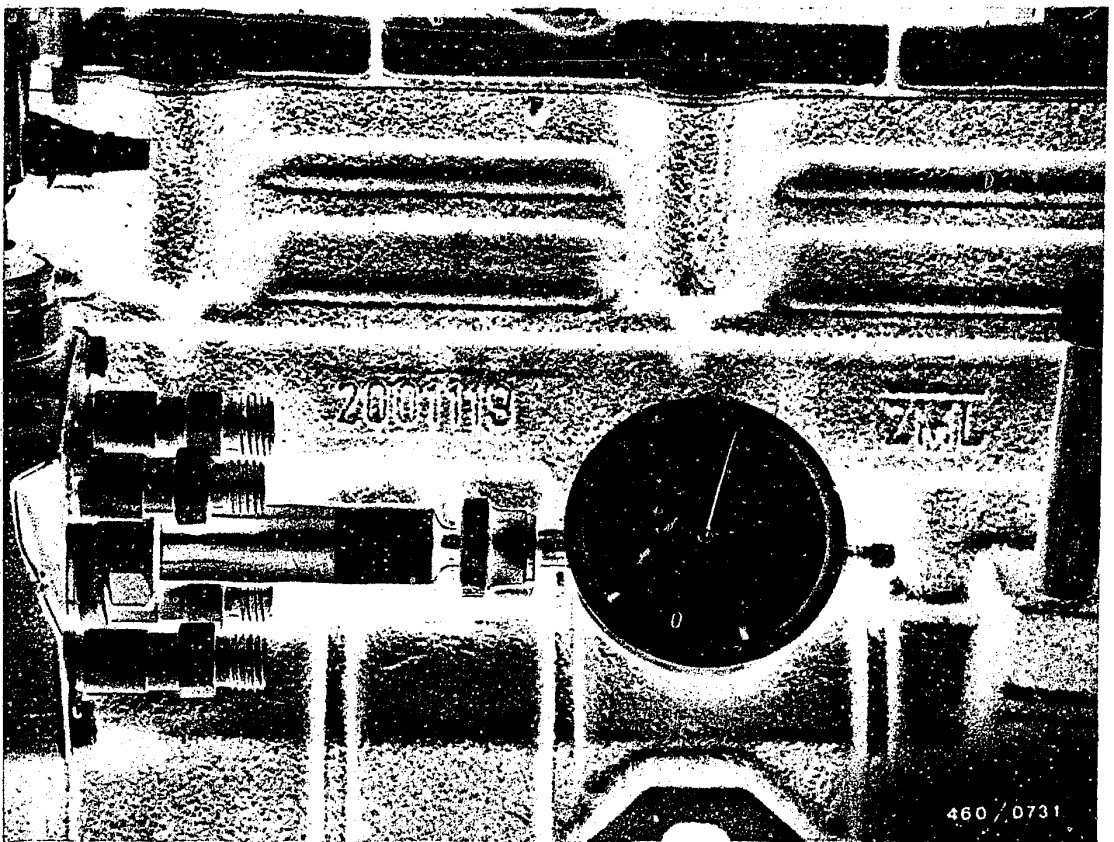
Turn crankshaft to TDC on cylinder 1 (timing gear end).

Mark on timing case must align with pulley mark (Fig. a, arrow).

Turn crankshaft 30° against engine direction of rotation (Fig. b, direction of arrow).

When testing and adjusting the start of delivery, the cold-start accelerator must be in the zero position.





Remove injection lines from injection pump and nozzle-holder assemblies (prevent delivery-valve holders from coming loose by holding with a wrench).

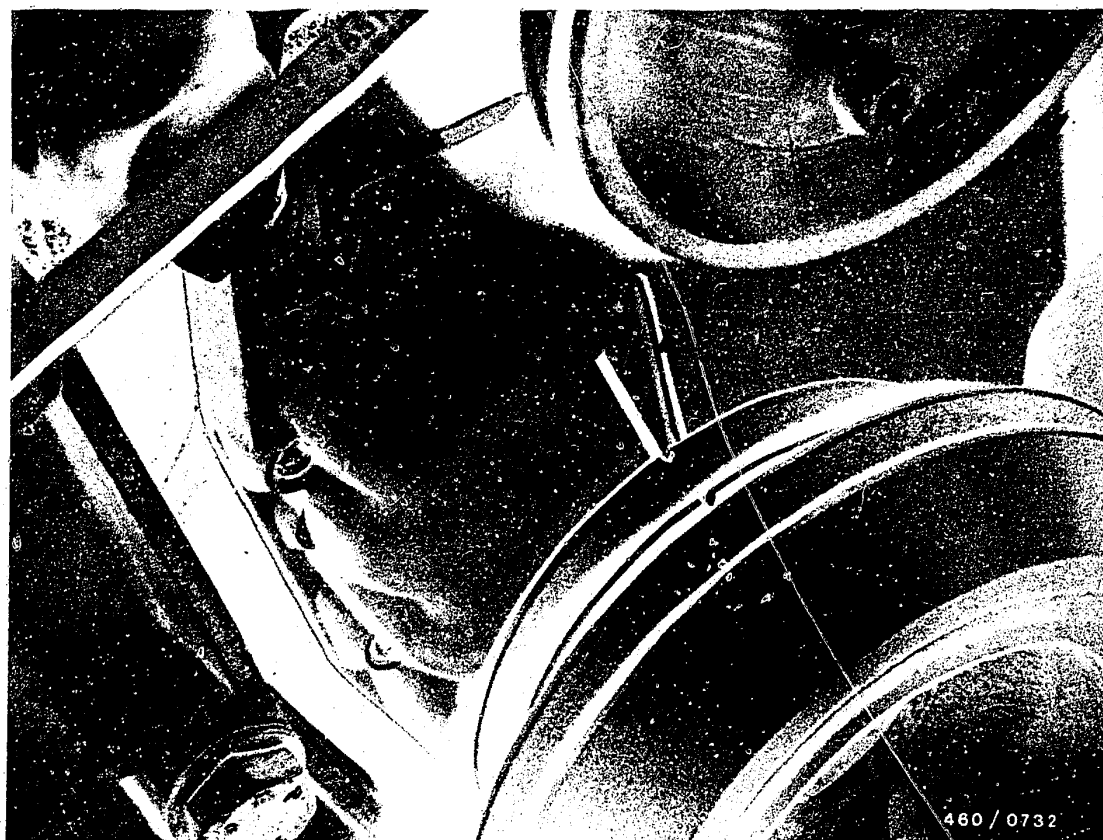
Unscrew bleeder screw from central screw plug (triangular screw) of hydraulic head.

Mount measuring tool KDEP 1085 or 1126 in this bore.

Insert dial indicator (e.g. 1 687 233 011) and pre-load by approx. 2 mm.

Turn crankshaft against engine direction of rotation until the pointer of the dial indicator no longer moves.





Set dial indicator to "0".

Set crankshaft in engine direction of rotation to the correct value for the vehicle.

Alfetta, Giulietta 2.0 1 4 cylinder TD $8^{\circ} \cong 8$ mm BTDC

Alfetta 2.4 1 4 cylinder TD $5^{\circ} \cong 5$ mm BTDC

Alfa 6 2.5 1 5 cylinder TD $6^{\circ} \cong 6$ mm BTDC

Note:

Remove millimeter indication on circumference of pulley (picture).

In the given crankshaft positions the dial indicator on the injection pump must indicate a plunger stroke of 0.50 mm ABDC



If necessary, make correction by pivoting the injection pump.

Tighten fastening screws to 25 Nm.

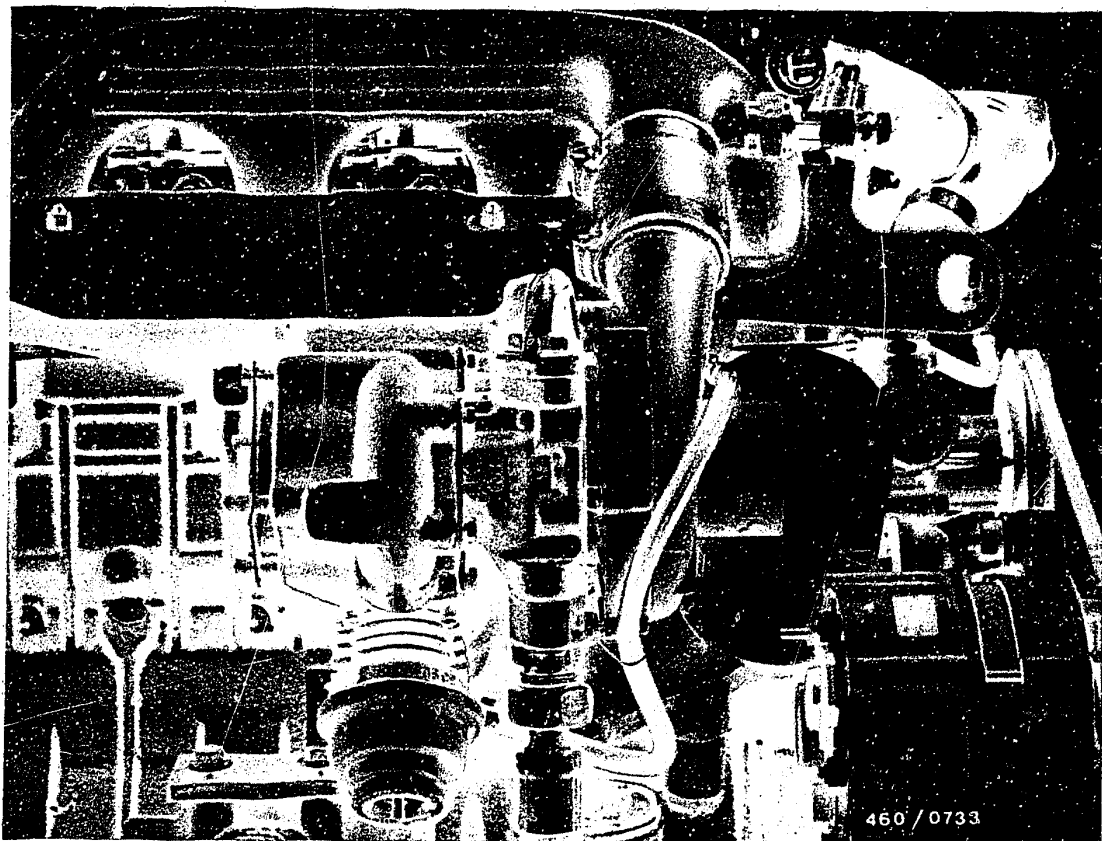
Remove measuring tool KDEP 1085 or 1126 with dial indicator.

Mount bleeder screw with new seal ring.

Tighten injection lines with box wrench KDEP 1115 (prevent delivery-valve holders from turning by holding with a wrench).

Mount cylinder head cover.





7. Test charge-air pressure

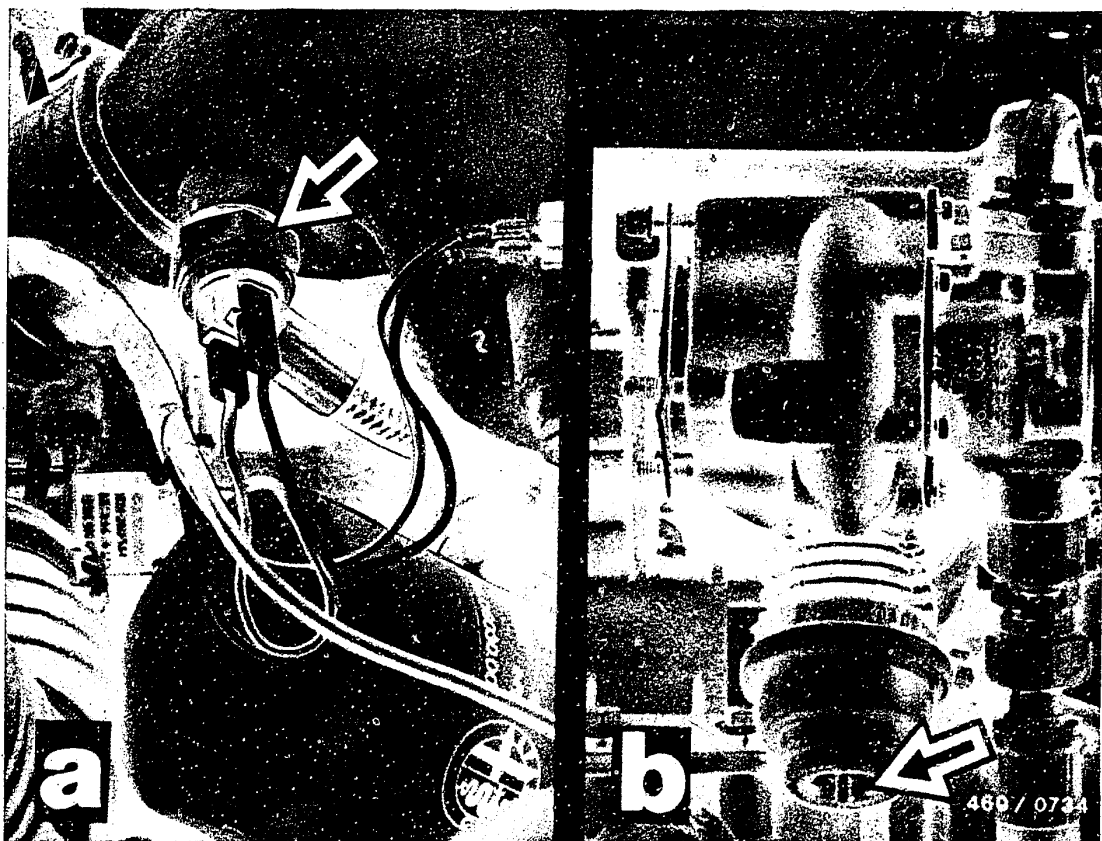
When working on the turbocharger remember that even the smallest particles of dirt can lead to the destruction of the turbocharger.

Therefore, never operate the engine without air filter.

For testing the charge-air pressure it is possible to use pressure tester KDJE-P 100 or a pressure gauge 0 ... 16 bar (e.g. Wika No. 4184).

The charge-air pressure can be measured either with the vehicle stationary or while driving.





Mounting the pressure tester for measuring charge-air pressure

Remove pressure switch from charge-air tube (Fig. a, arrow).

Screw in fitting 12 x 1.5 and establish connection to pressure gauge by means of commercially available hose.

- Charge-air pressure measurement with vehicle stationary without load

At 4000 min^{-1} 0.40 ... 0.46 bar

- Charge-air pressure measurement while driving at load

At 4200 min^{-1} in 4th gear max. 0.9 bar

Charge-air pressure too high/low (no leaks)

Adjust or, if necessary, replace wastegate (Fig. b, arrow).



Charge-air pressure measurement

Note:

In order to assess the exhaust-gas turbocharger make sure of the following: Engine at normal operating temperature, start of delivery and nozzle-opening pressure correctly set, air-intake side and exhaust side without leaks, mechanical condition of engine (valve clearance, compression pressure) O.K.

After installing a new turbocharger, fill turbocharger with oil and allow engine to idle for approx. 1 minute so that there is a guaranteed supply of oil to the turbocharger.



TABLE OF CONTENTS

<u>Section</u>	<u>Coordinates</u>
Rapid diagnosis chart for universal test adapter	B 2 - B 6
Test specifications	B 7 - B 8
Electrical terminal diagram	B 9 - B 10
Electrical wiring diagram	B 11 - B 12
Diagram of air and fuel hoses	B 13 - B 14
Diagram of fuel lines	B 15
Fuel pressure test	B 16
Installation position of components	B 17 - B 21



SPECIAL FEATURES

L-Jetronic with control unit 0 280 001 117

RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER

Universal test adapter 0 684 101 801
and

adapter lead 1 684 463 129

The following rapid diagnosis chart makes it possible for the experienced L-Jetronic expert to quickly check the electrical part of the system with the universal test adapter.

The rapid diagnosis chart contains the following information

- Switch positions on universal test adapter
- Sequence of test steps
- Notes on how to use the universal test adapter or other components
- Readings on multimeter
- References to coordinates of the respective detailed testing and trouble-shooting program.



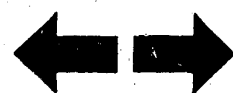
Rapid diagnosis chart for universal test adapter

Test step	Switch position		Measurement	Remarks	Test specifications (reading)
	V	Ω			
1	3	-	Voltage from starting motor term. 50. Control-unit plug term. 4 to term. 5.	Shift gear to neutral, operate starting motor	<u>8 ... 15 V</u>
2	4	-	Voltage from relay set term. 88 c. Control-unit plug term. 34 to term. 5.		<u>8 ... 15 V</u>
3	5	-	Voltage pulses from ignition coil term. 1. Control-unit plug term. 1 to term. 5.	Shift gear to neutral, operate starting motor	Ignition pulses on oscilloscope
4	6	-	Voltage from relay set term. 88 a. Control-unit plug term. 10 to term. 5.	Ignition "ON".	<u>8 ... 15 V</u>
5	7	-	Voltage from 1st injection valve term. 15. Control-unit plug term. 15 to term. 5.	Ignition "ON".	<u>8 ... 15 V</u>
6	8	-	Voltage from 2nd injection valve term. 33. Control-unit plug term. 33 to term. 5.	Ignition "ON".	<u>8 ... 15 V</u>
7	9	-	Voltage from 3rd injection valve term. 32. Control-unit plug term. 32 to term. 5.	Ignition "ON".	<u>8 ... 15 V</u>
8	10	-	Voltage from 4th injection valve term. 14. Control-unit plug term. 14 to term. 5.	Ignition "ON".	<u>8 ... 15 V</u>
9	11	-	Voltage through pump contact in air-flow sensor from relay set term. 86 b. Control-unit plug term. 20 to term. 5.	Ignition "ON".	<u>8 ... 15 V</u>
10	12	-	Voltage from relay set term. 88 b. Control-unit plug term. 29 to term. 5.	Ignition "ON".	<u>8 ... 15 V</u>
11	13	-	Voltage from 5th injection valve term. 30. Control-unit plug term. 30 to term. 5.	Ignition "ON".	<u>8 ... 15 V</u>
12	14	-	Voltage from 6th injection valve term. 31. Control-unit plug term. 31 to term. 5.	Ignition "ON".	<u>8 ... 15 V</u>

B3

Rapid diagnosis chart

Alfa Romeo GTV 6 / 2.5













B4

Rapid diagnosis chart

Alfa Romeo GTV 6 / 2.5



Rapid diagnosis chart for universal test adapter

Test step	Switch position		Measurement	Remarks	Test specifications (reading)
	V	Ω			
13		6	Resistance of potentiometer (wiper in air-flow sensor term. 7. Control-unit plug term. 7 to term. 5.	Deflect air-flow sensor flap as far as it will go.	<u>80 ... 600 Ω</u>
14		7	Resistance of potentiometer (total resistance) in air-flow sensor term. 8. Control-unit plug term. 8 to term. 5.	-----	<u>260... 520 Ω</u>
15		8	Series resistor and potentiometer total resistance in air-flow sensor term. 9. Control-unit plug term. 9 to term. 5.	-----	<u>400 ... 800 Ω</u>
16		9	Resistance of idle contact in throttle-valve switch term. 2. Control-unit plug term. 2 to term. 18.	Accelerator in rest position: Accelerator slightly depressed:	<u>0 ... 10 Ω</u> <u>∞ Ω</u>
17		10	Resistance of full-load contact in throttle-valve switch term. 3. Control-unit plug term. 3 to term. 18.	Accelerator in full-load position: Accelerator slightly depressed:	<u>0 ... 10 Ω</u> <u>∞ Ω</u>
18		11	Resistance of temperature sensor NTC I in air-flow sensor term. 27. Control-unit plug term. 27 to term. 5.	-----	at +15°C...+30° C: <u>1.45...3.3 k Ω</u> at + 80° C: <u>280 ... 360 Ω</u>
19		12	Resistance of temperature sensor NTC II term. 13 (engine temperature). Control-unit plug term. 13 to term. 5.	-----	at +15°C...+30° C: <u>1.3...3.6 k Ω</u> at 80° C: <u>250 ... 390 Ω</u>
20		13	Resistance ground - output stage term. 16. Control-unit plug term. 16 to term. 5.	-----	<u>0 ... 10 Ω</u>
21		14	Resistance ground - output stage term. 17. Control-unit plug term. 17 to term. 5.	-----	<u>0 ... 10 Ω</u>
22		15	Resistance ground - output stage term. 35. Control-unit plug term. 35 to term. 5.	-----	<u>0 ... 10 Ω</u>

B5

Rapid diagnosis chart
Alfa Romeo GTV 6 / 2.5



B6

Rapid diagnosis chart
Alfa Romeo GTV 6 / 2.5



TEST SPECIFICATIONS

- Air-flow sensor

Resistance between term. 7 and term 8

(deflect air-flow sensor flap): 200 ... 1000 Ω

- Relay set

Resistance measurement between term. 86b

(positive pole of ohmmeter) and
term 85:

70 ... 500 Ω

- Auxiliary-air device

25 ... 60 Ω

- Idle speed

Manually-shifted and automatic
transmission:

800 ... 1000min⁻¹

- Exhaust-gas setting

CO concentration with engine
at op. temp.:

0.5...1.5%by Vol.CO

- Fuel pressure:

2.3 ... 2.7 bar

- Fuel pump delivery: min.

800 cm³/30s

- Solenoid-op. injection valve:

2 ... 3 Ω

- Temperature sensors

NTC I

NTC II

Ambient temp.

(+15° C...+30° C):

1.45...3.3k Ω

1.30...3.6k Ω

Engine at op. temp.

(approx. + 80° C):

280...360 Ω

250...390 Ω

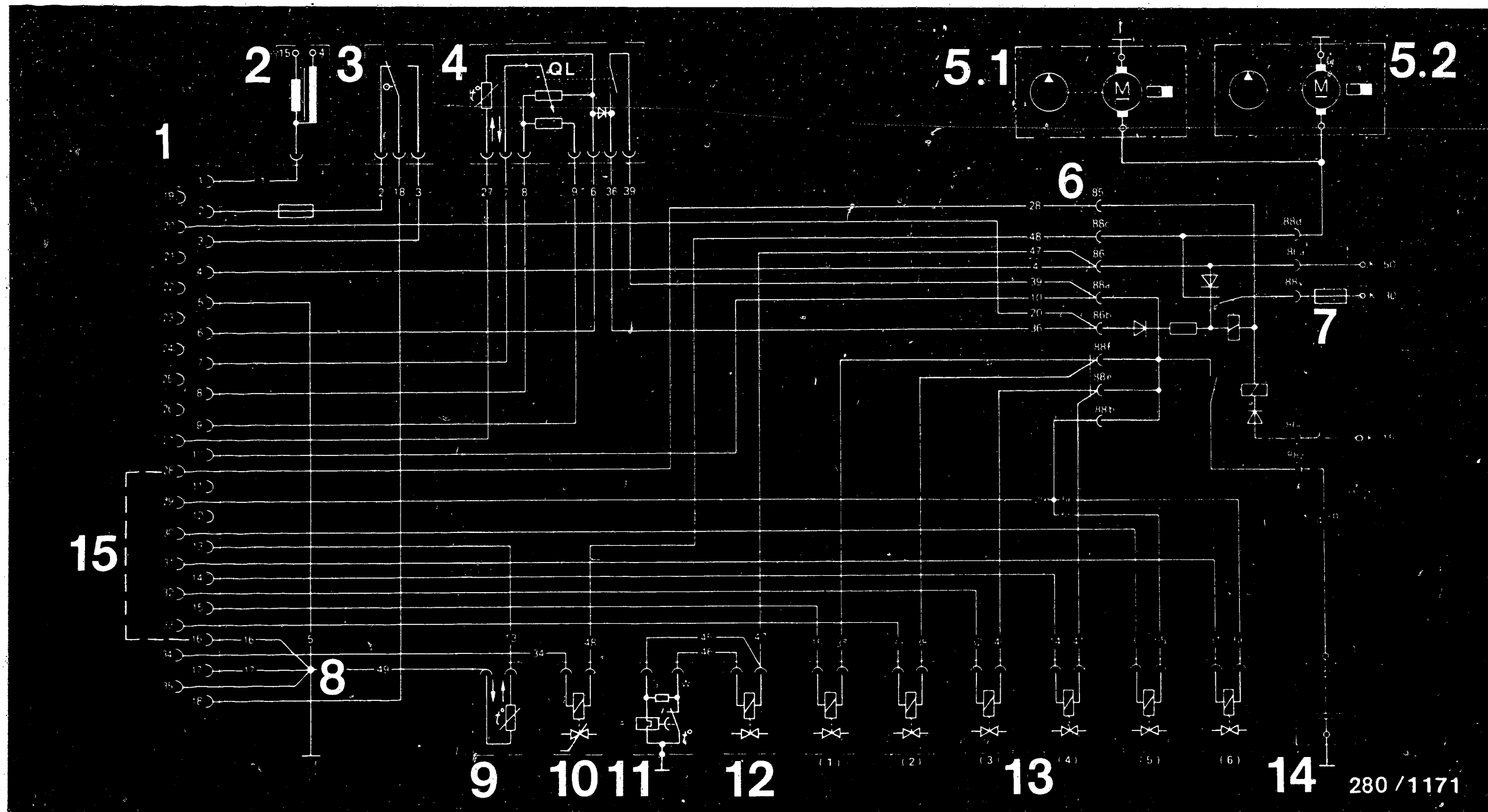


- Thermo-time switch
for 0 280 130 214:

	Electrical internal resistance:		
	"G" and ground	"W" and ground	"G" and "W"
Ambient temp. (below + 30° C):	25...40 Ω	0 Ω	25...40 Ω
Engine at op. temp. (above + 40° C):	50...80 Ω	100...160 Ω	50...80 Ω

- See equipment and Autodata microfiches for settings for ignition, valve clearance and other engine data.





ELECTRICAL TERMINAL DIAGRAM

1 = Control-unit plug
2 = Ignition coil
3 = Throttle-valve switch

4 = Air-flow sensor
5 = Electric fuel pump
6 = Relay set

7 = Pump fuse
8 = Central ground
9 = Temperature sensor II
10 = Auxiliary-air device

11 = Thermo-time switch
12 = Start valve
13 = Injection valves
14 = Battery
15 = Jumper in control unit

B9

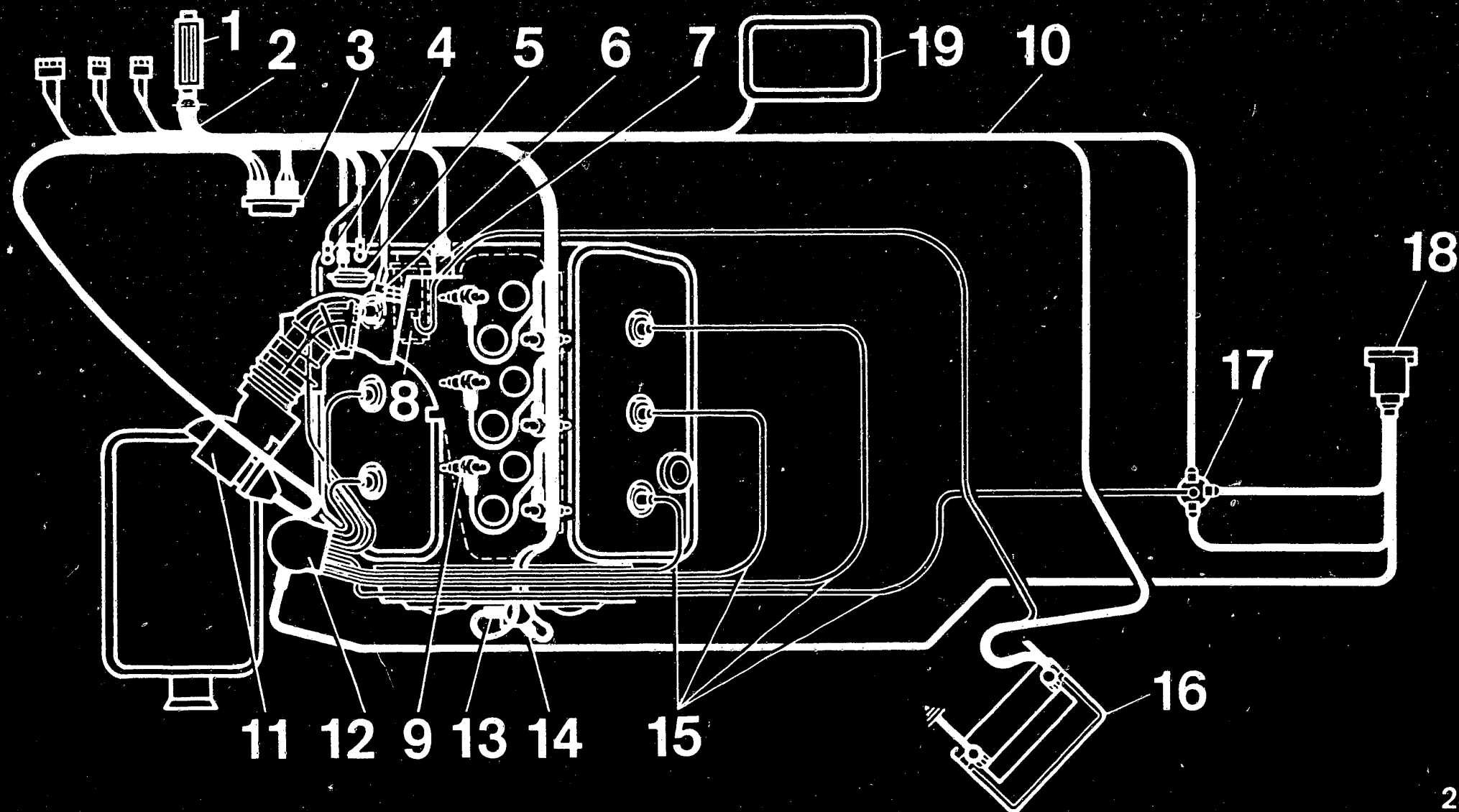
Electrical terminal diagram
Alfa Romeo GTV 6 / 2.5



B10

Electrical terminal diagram
Alfa Romeo GTV 6 / 2.5





280 / 1150

ELECTRICAL WIRING DIAGRAM OF L-JETRONIC AND ARRANGEMENT OF INDIVIDUAL COMPONENTS

1 = Control unit	6 = Throttle-valve switch	11 = Air-flow sensor	16 = Thermo-time switch
2 = Jetronic wiring harness	7 = Start valve	12 = Ignition distributor	17 = Temperature sensor
3 = Relay set	8 = Starting motor	13 = TCI trigger box	18 = Battery (in luggage compartment)
4 = Ground terminals	9 = Injection valves	14 = Ballast resistor	19 = Fuse box
5 = Auxiliary-air device	10 = Vehicle wiring harness	15 = Ignition coil	

B11

Electrical wiring diagram

Alfa Romeo GTV 6 / 2.5

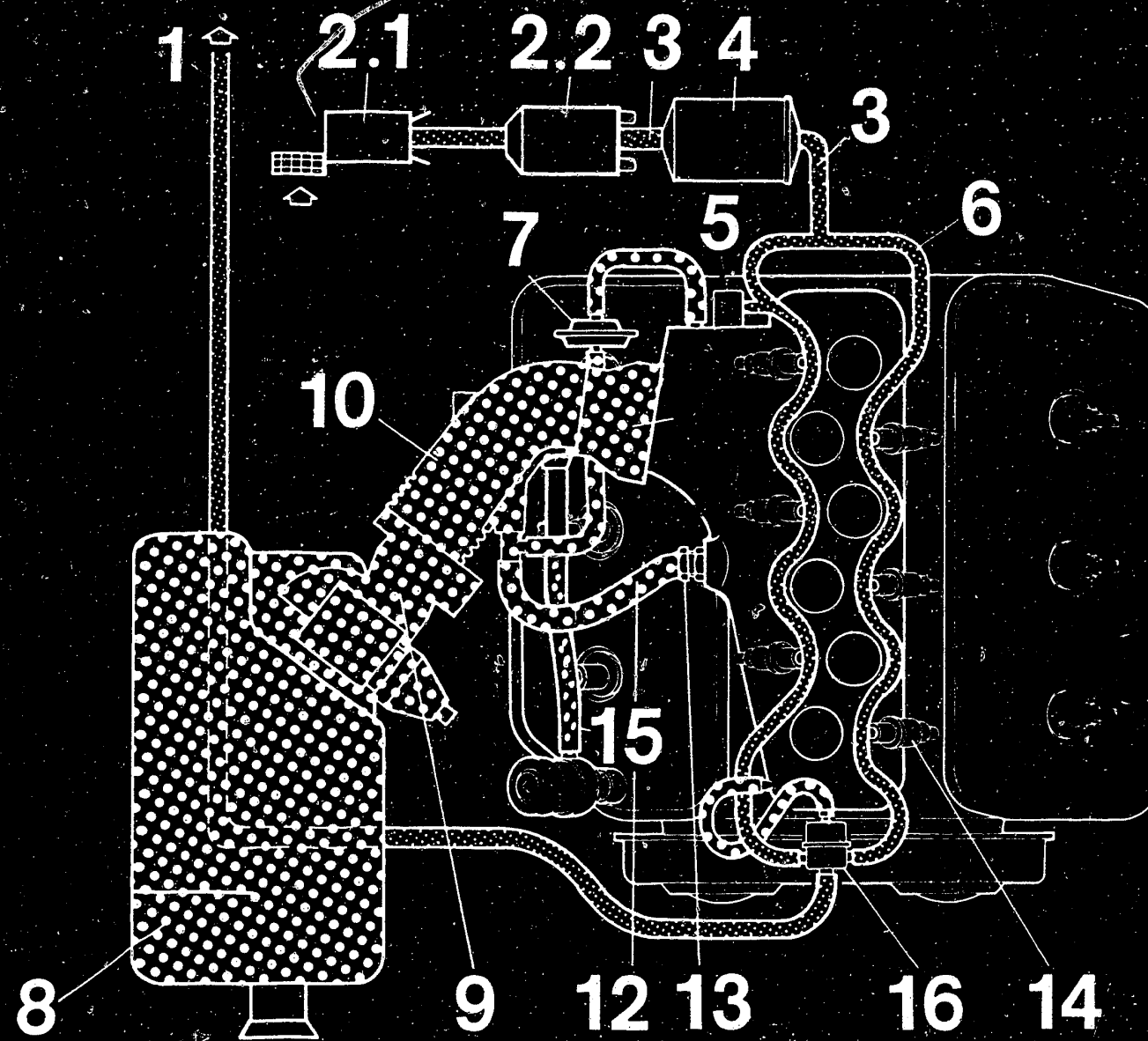


B12

Electrical wiring diagram

Alfa Romeo GTV 6 / 2.5





280 / 1151

DIAGRAM OF AIR AND FUEL HOSES

- 1 = Fuel return line
- 2 = Electric fuel pump
- 3 = Fuel delivery line
- 4 = Fuel filter
- 5 = Start valve

- 6 = Fuel ring main
- 7 = Auxiliary-air device
- 8 = Air filter
- 9 = Air-flow sensor
- 10 = Air-flow sensor hose

- 11 = Throttle-valve body
- 12 = Idle hose
- 13 = Hexagon nut for idle adjustment
- 14 = Injection valve
- 15 = Crankcase breather

- 16 = Pressure regulator



B13

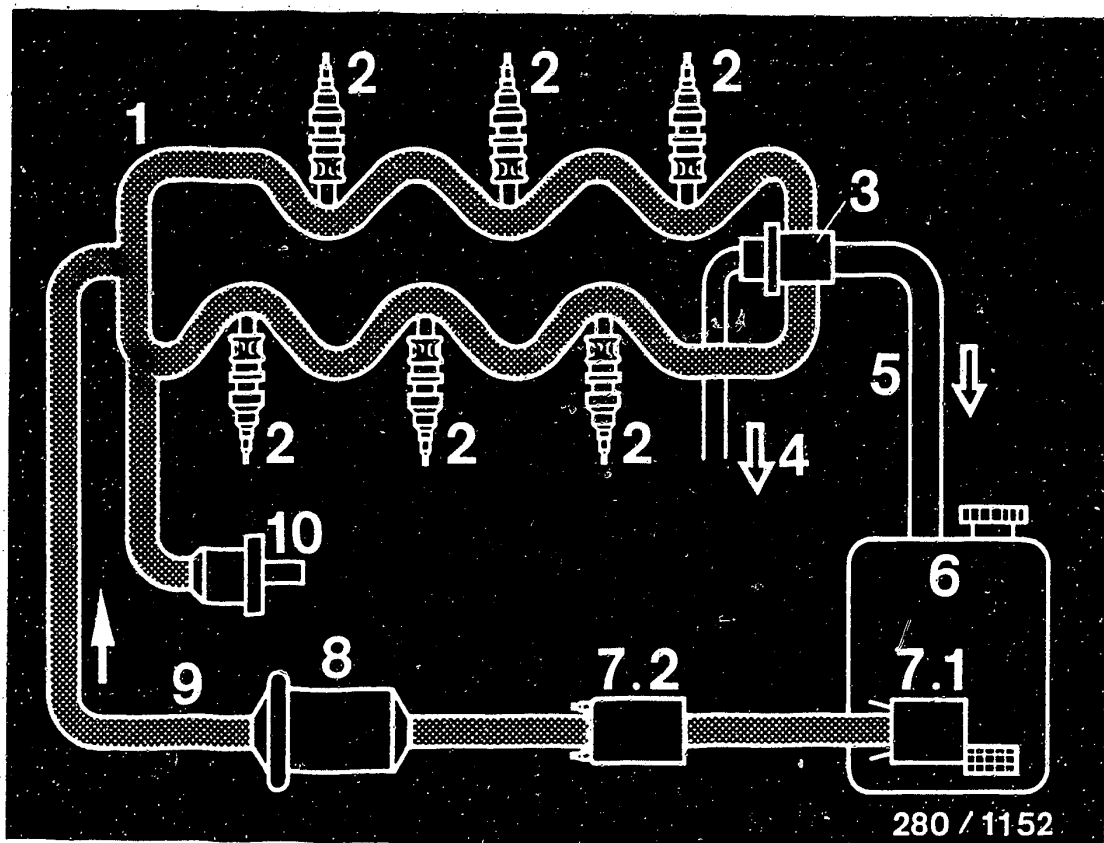
Diagram of air and fuel hoses
Alfa Romeo GTV 6 / 2.5



B14

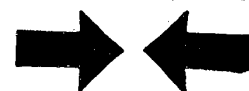
Diagram of air and fuel hoses
Alfa Romeo GTV 6 / 2.5

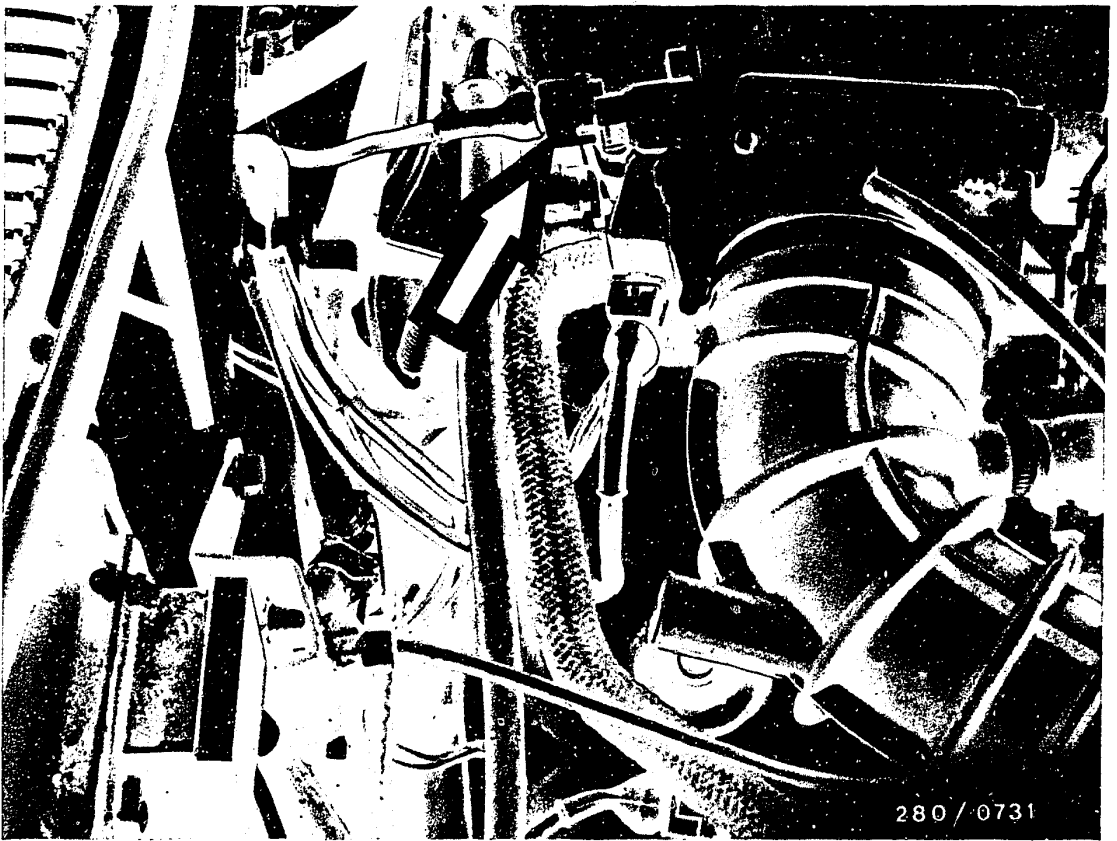




- 1 = Fuel tank
- 2 = Electric fuel pump (tube-type pump)
- 3 = Fuel filter
- 4 = Fuel delivery line
- 5 = Solenoid-operated injection valve
- 6 = Fuel-distribution pipe
- 7 = Pressure regulator
- 8 = To intake manifold
- 9 = Fuel return line
- 10 = Start valve

DIAGRAM OF FUEL LINES





Arrow = start valve

FUEL PRESSURE TEST

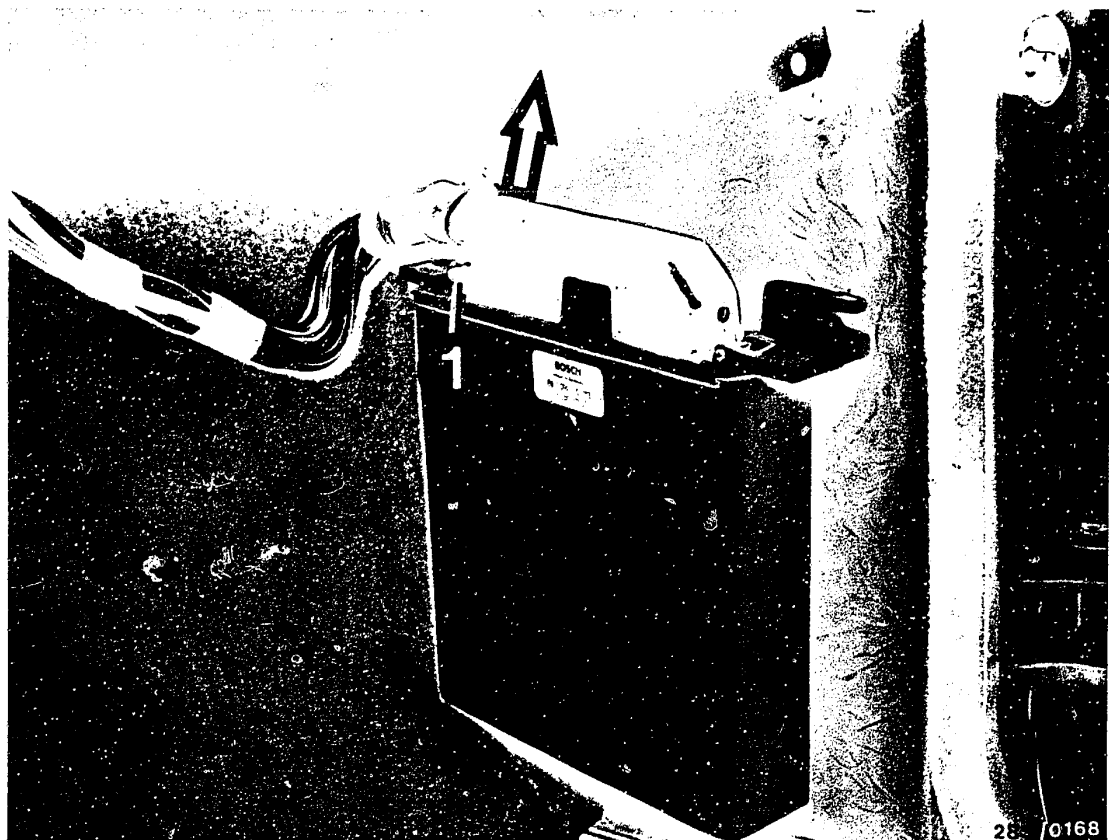
Disconnect hose from start valve (arrow).

Connect pressure gauge.

Make sure there are no leaks at connections.

Do not damage start valve when disconnecting and connecting the fuel delivery hose.





INSTALLATION POSITION OF COMPONENTS

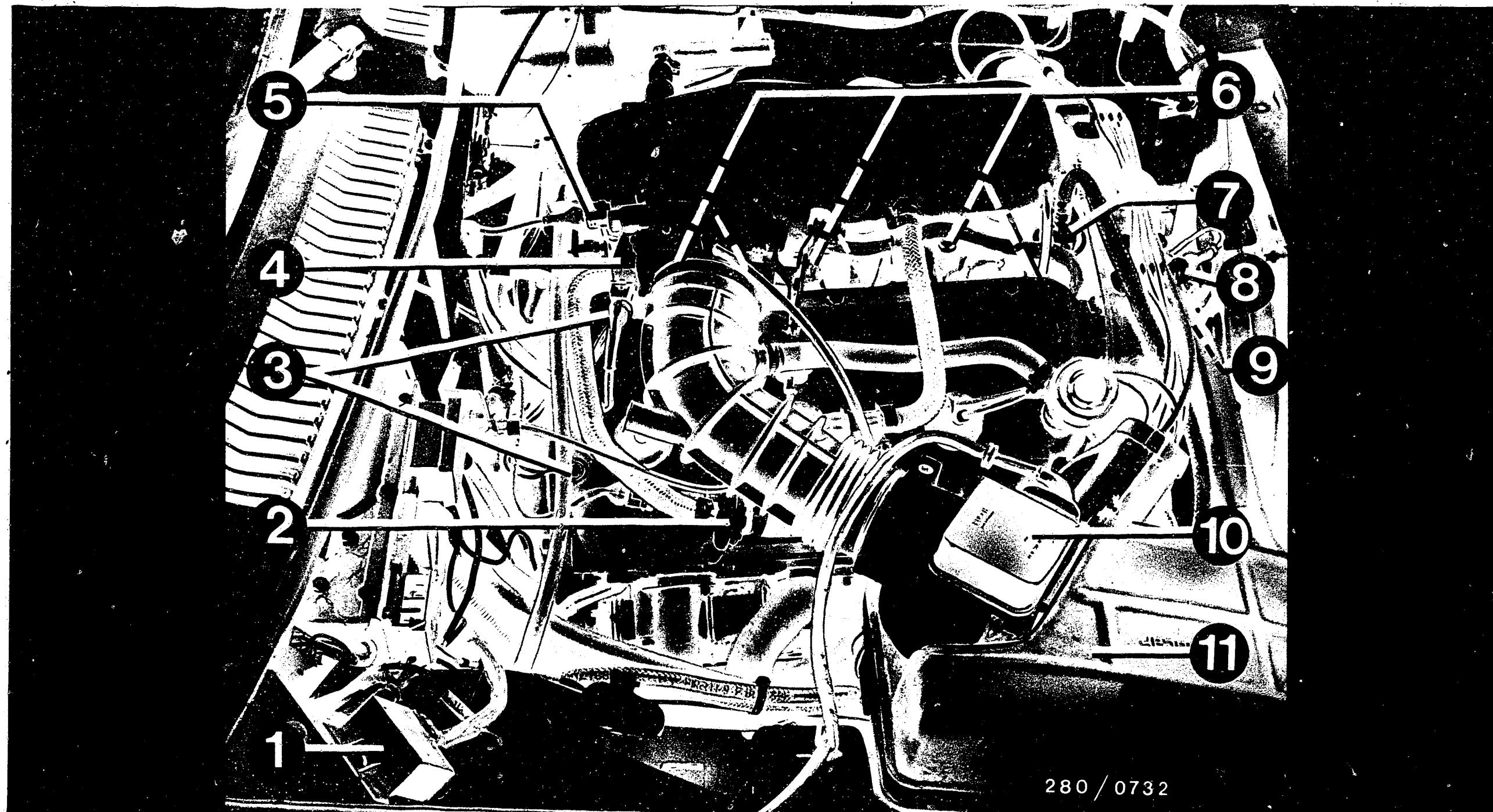
To remove the control unit, remove the side panelling under the glove compartment on the right-hand side in the front-passenger footwell.

Unscrew the 3 fastening screws of the control unit.

Press detent (1) to the rear so that plug unlatches.

Hinge up plug in direction of arrow.





280 / 0732

1 = Relay set
2 = Auxiliary-air device
3 = Central ground

4 = Throttle-valve switch
5 = Start valve
6 = Injection valves

7 = Pressure regulator
8 = Temperature sensor
9 = Thermo-time switch

10 = Air-flow sensor
11 = Air filter

Installation position of components (continued)

B18

Installation position of components
Alfa Romeo GTV 6 / 2.5



B19

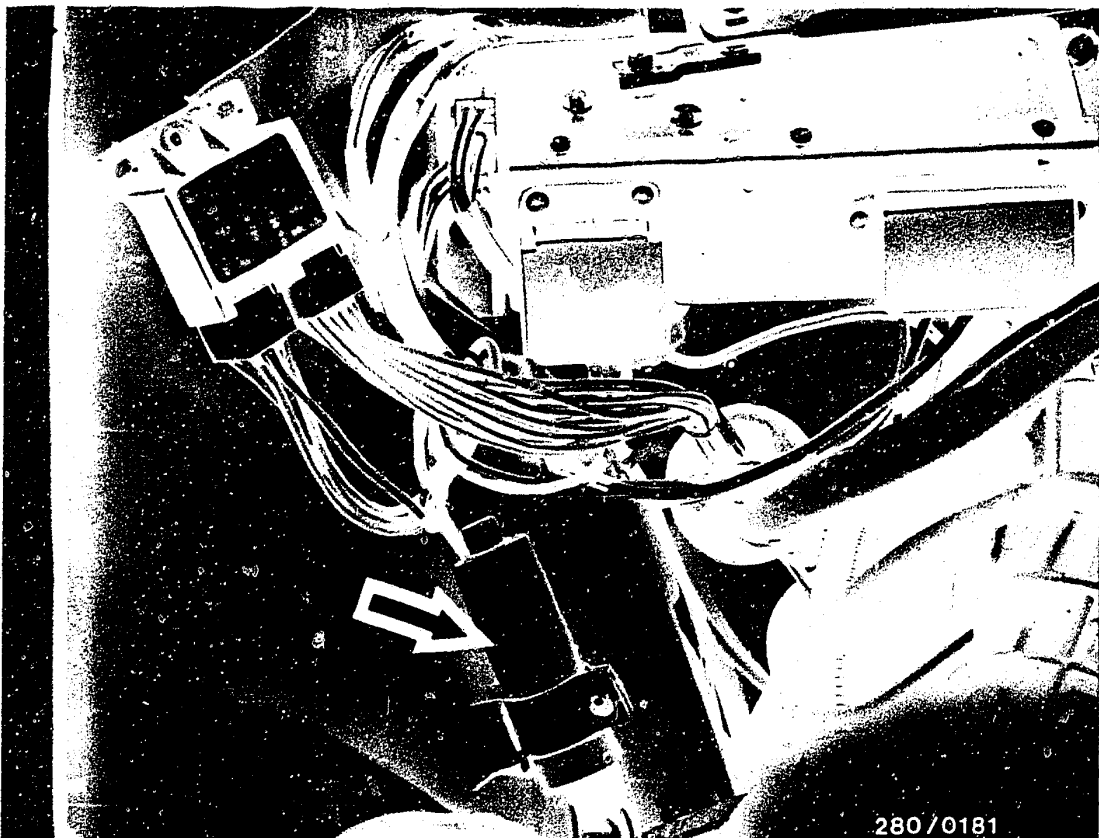
Installation position of components
Alfa Romeo GTV / 2.5



Installation position of components (continued)

- Electric fuel pump: Under vehicle, on right-hand side in front of rear axle.
- Fuel filter: Under vehicle, on right-hand side in front of rear axle.
- Electric fuel pump fuse: In central fuse box no. 7.





Arrow = safety switch

Installation position of components (continued)

The safety switch is in the engine compartment on the right-hand side viewed in the forward direction of travel.

The electrical connections are accessible.

In the case of a serious accident (rolling over) the safety switch switches off the fuel pump.

The pump continues to operate if the knob is pressed downward.

The colours of the connecting leads must match between plug and socket.



TABLE OF CONTENTS

<u>Section</u>	<u>Coordinates</u>
1. Test specifications	A 2
2. Terminal diagram for preheating system	A 3
3. Tools, test equipment	A 5
4. Remove fuel-injection pump	A 6
5. Install fuel-injection pump	A 11
6. Test injection timing	A 19
7. Test charge-air pressure	A 23



1. Test specifications

1.1 Idle speed: $850 \pm 50 \text{ min}^{-1}$

1.2 Nozzle-opening pressure: $150 + 8 \text{ bar}$

1.3 Injection timing - pump-engine:

Alfa 90 2.4 l 4-cyl. turbo diesel

Engine position: Cylinder 1 at TDC

Pump position: $0.78 \dots 0.80 \text{ mm ABDC}$

1.4 Compression pressure: $21 \dots 22 \text{ bar}$

1.5 Charge-air pressure: $0.39 \dots 0.45 \text{ bar}$ at 4000 min^{-1} without load
max. 0.88 bar at maximum speed with load

1.6 Tightening torques

Injection-pump gear 88 Nm

Nozzle-holder assembly $25 \dots 30 \text{ Nm}$

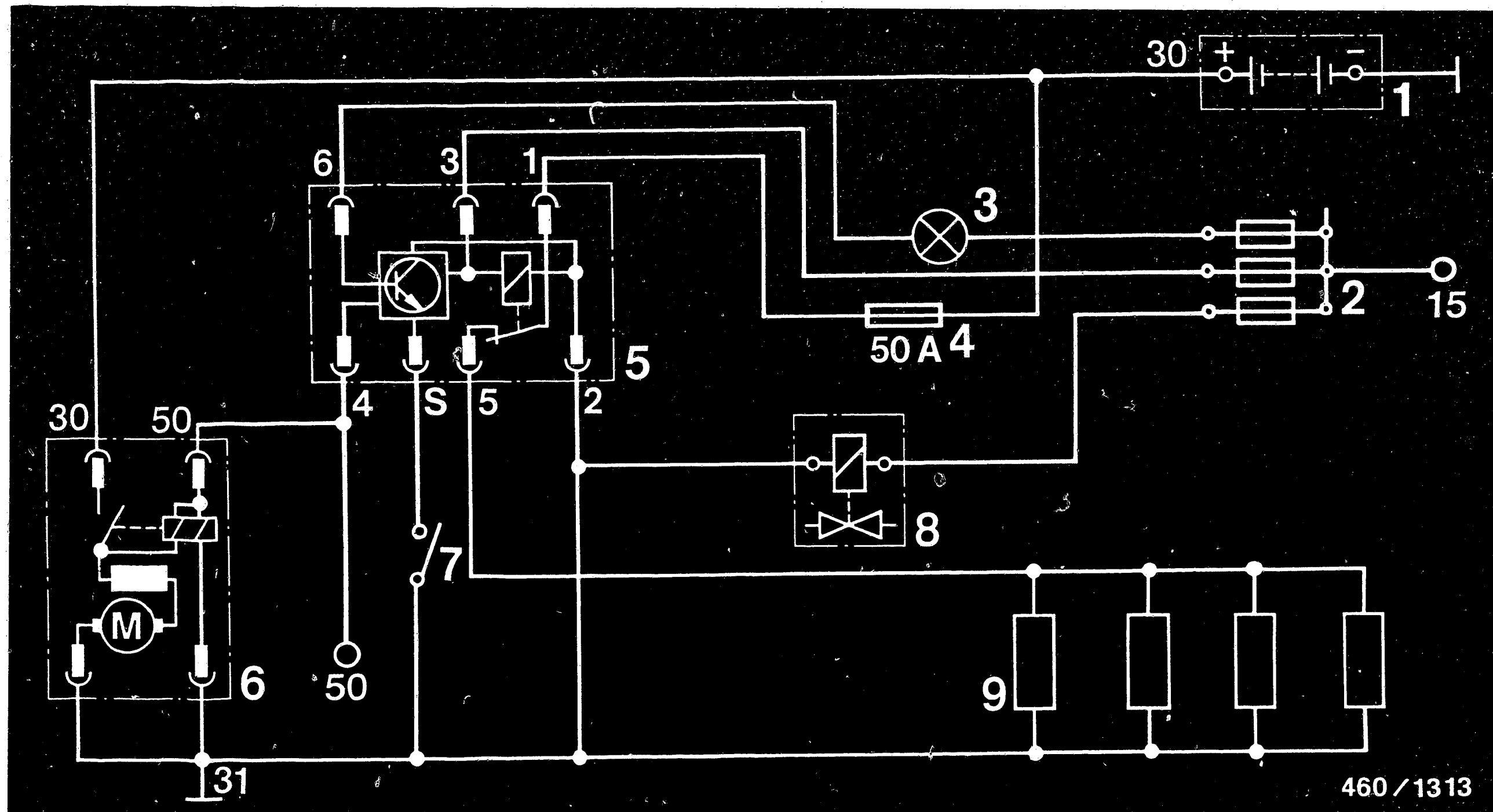
Fuel lines $15 \dots 20 \text{ Nm}$

Injection-pump fastening screws 25 Nm

Fuel line inlet-union screws 25 Nm

Screw plug 10 Nm





460 / 1313

1 = Battery
2 = Fuse box
3 = Glow-plug indicator lamp (12V max. 2W)

4 = Fuse 50A
5 = Glow-duration relay
6 = Starting motor

7 = Microswitch (VE pump)
8 = Solenoid-operated valve
9 = Glow plugs

2. Terminal diagram for preheating system

C3

Check preheating system
Alfa-Romeo 90 Turbo-Diesel



C4

Check preheating system
Alfa-Romeo 90 Turbo-Diesel

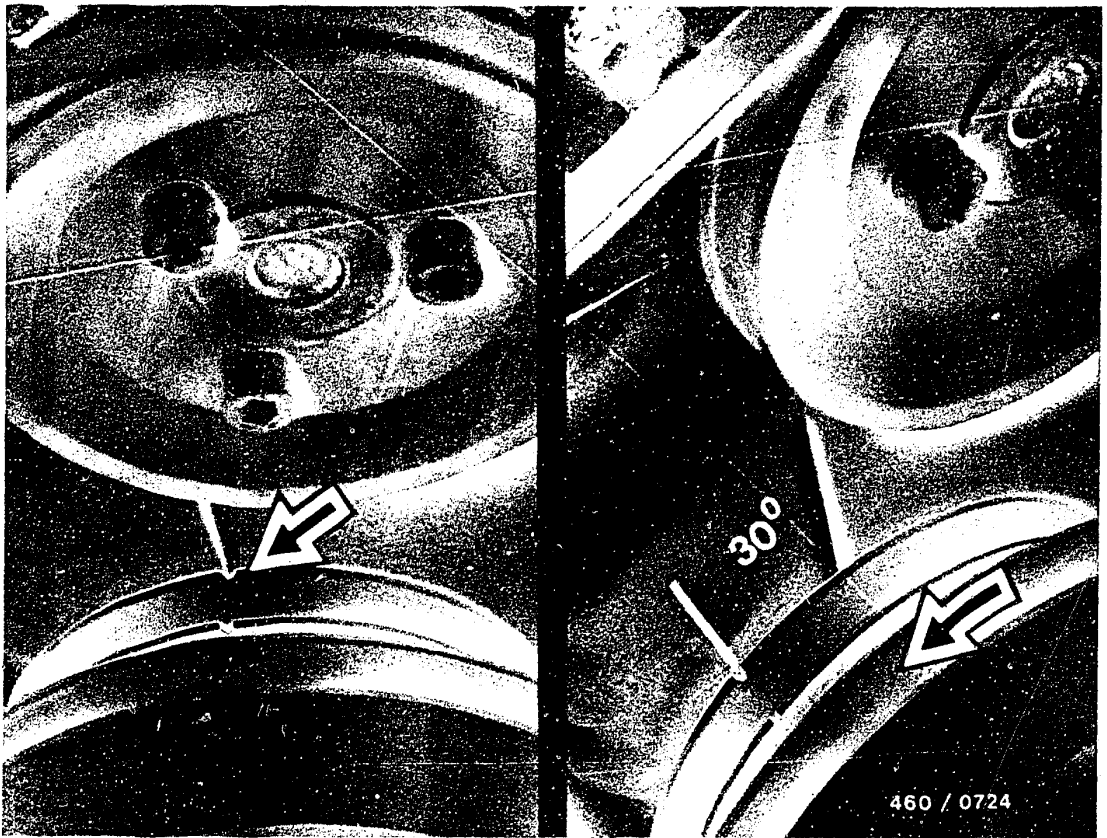


3. Test equipment and tools

Holding and press-out device	A 7. 0 384*	Locking injection-pump drive gear
Pressure tester or pressure gauge 0 ... 1.6 bar	KDJE-P 100 e.g. W i k a No. 4 184	Checking charge-air pressure
Measuring tool	KDEP 1085 KDEP 1126	Injection timing
Mini dial indicator 1/100 mm divisions	1 687 233 011	Injection timing

* Obtainable through Alfa Romeo agent.





4. Remove fuel-injection pump

Remove cylinder cover.

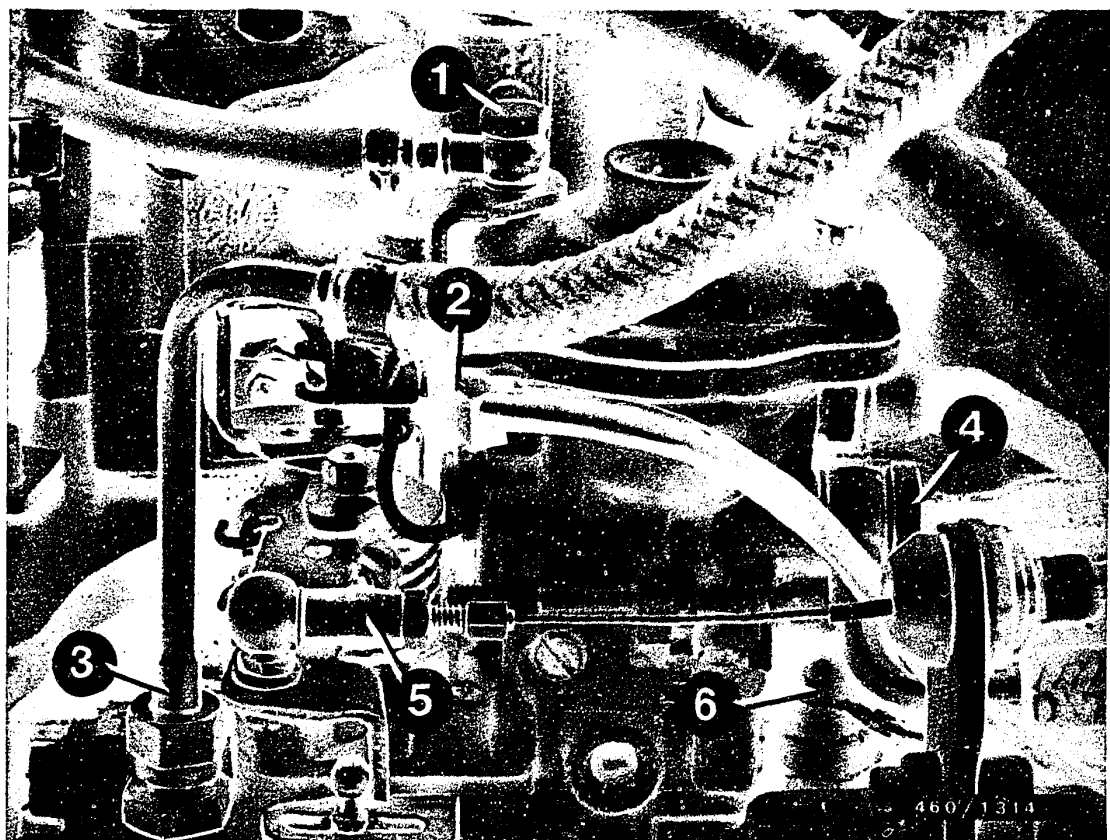
Turn crankshaft to TDC on cylinder 1 (timing gear end).

Mark on timing case must align with pulley mark (Fig. a, arrow).

Turn crankshaft 30° against engine direction of rotation (Fig. b, direction of arrow).

Remove battery.



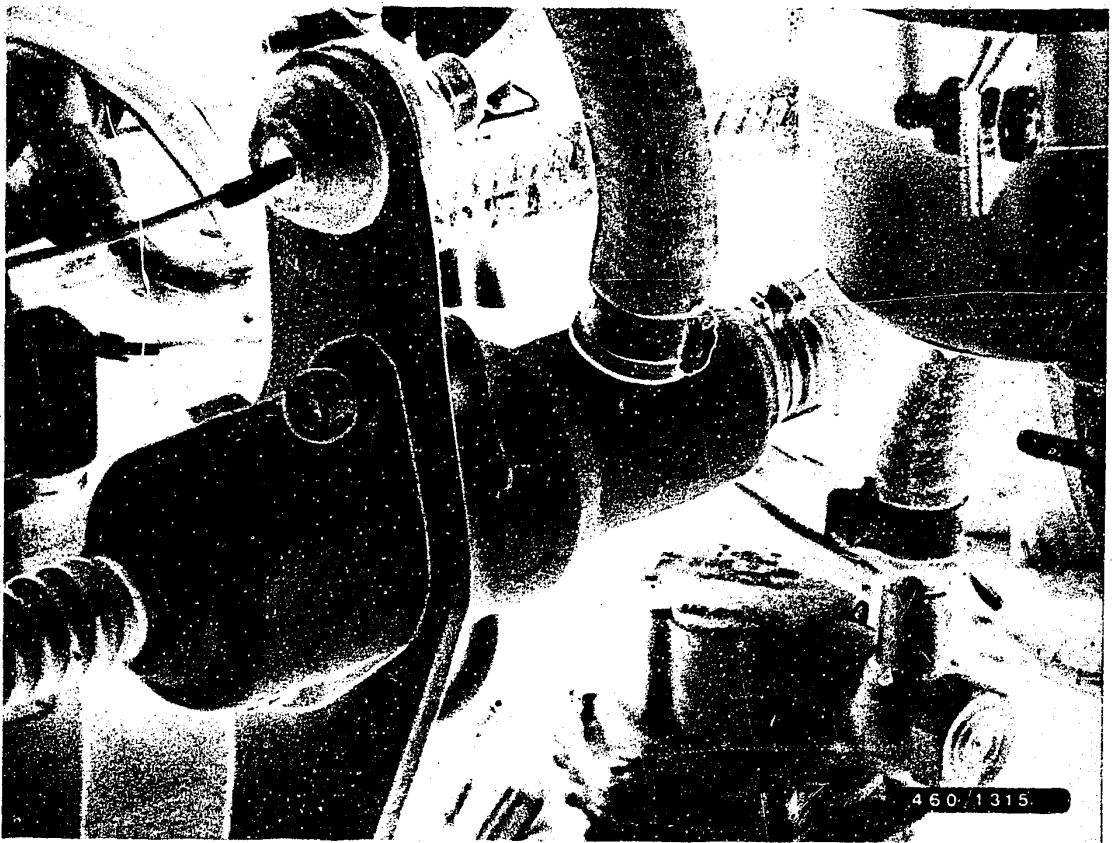


Remove charge-air pressure connection (1), electric lead on microswitch (2), fuel inlet line (3), return line (4), cable on injection-pump control lever (5) and electric lead on shutoff solenoid (6).

C7

Remove fuel-injection pump
Alfa-Romeo 90 Turbo-Diesel



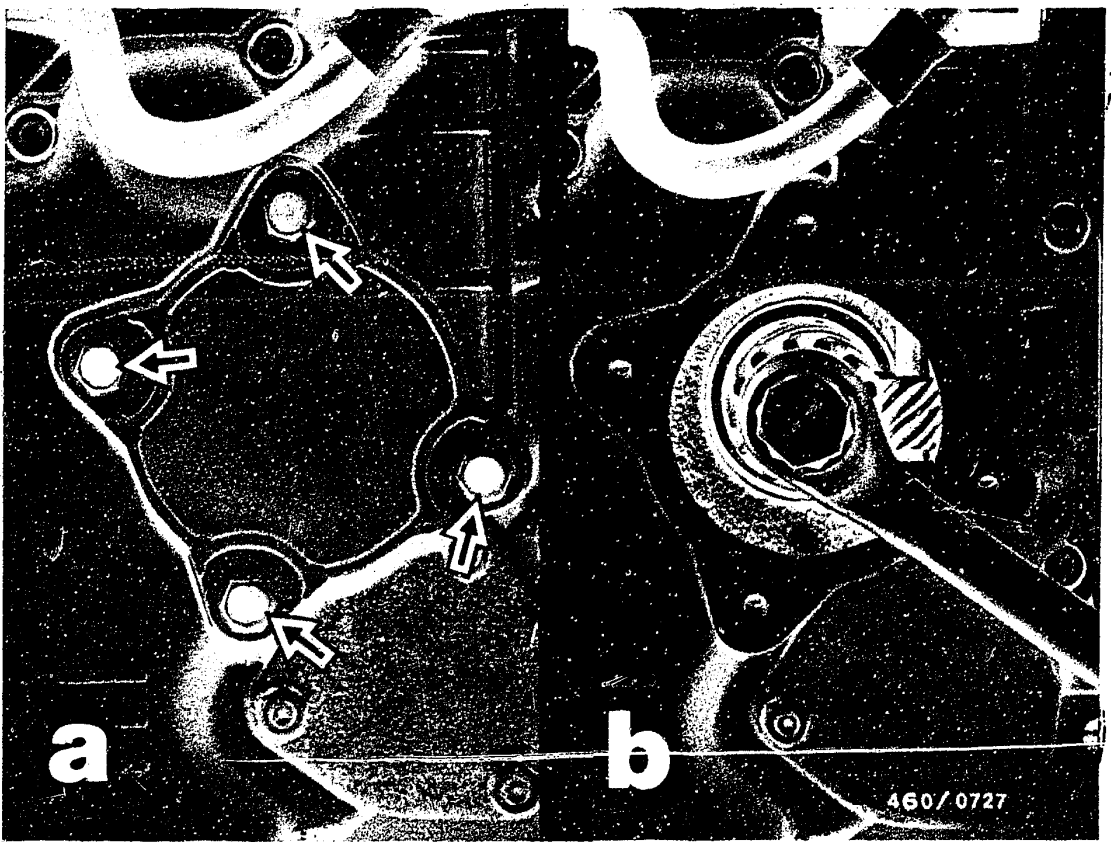


Using commercially available hose clampers, pinch off coolant hoses just after injection-pump control device.

Loosen hose binders and disconnect coolant hoses.

Remove injection lines.
(Prevent delivery-valve holders from coming loose by holding with a wrench).

Unscrew injection-pump fastening nuts.

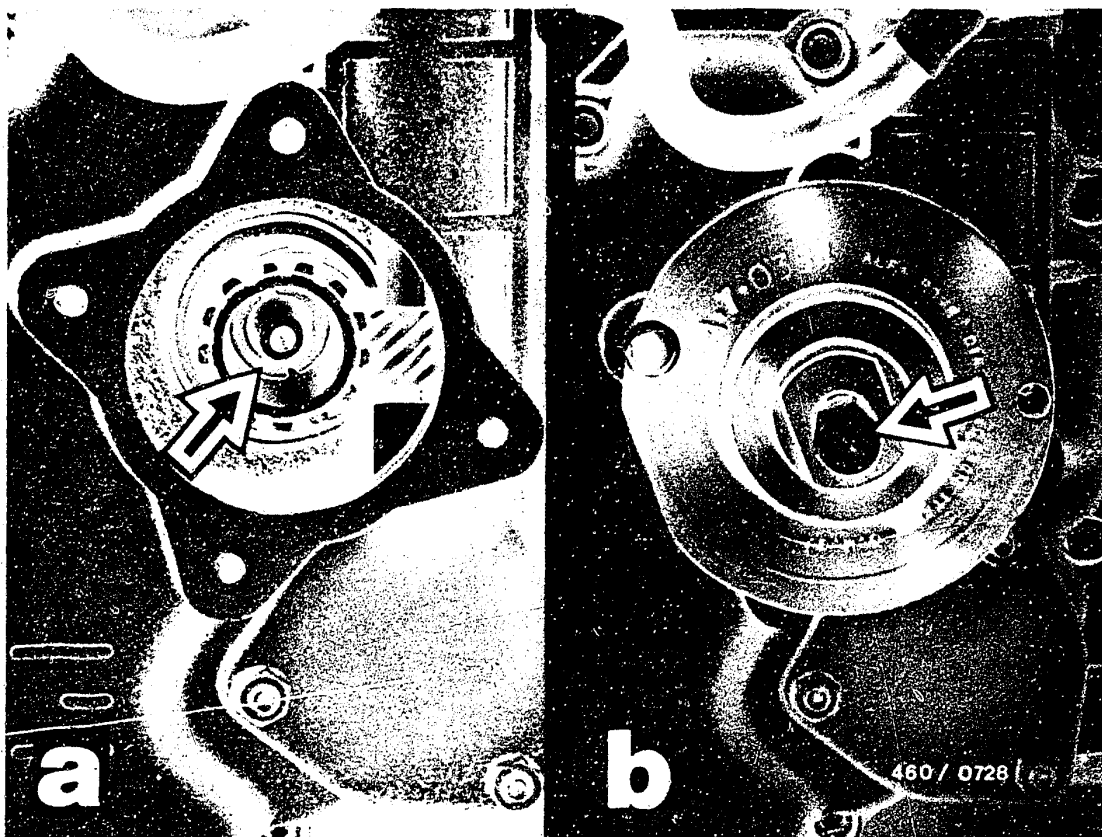


Remove fastening screws (Fig. a, arrow) from injection-pump drive gear closing cover.

Remove closing cover.

Unscrew injection-pump gear fastening screw (Fig. b).





Screw threaded sleeve of holding and press-out device into vacuum pump drive gear (Fig. a, arrow).

Fix device with a screw of the closing cover (Fig. b).

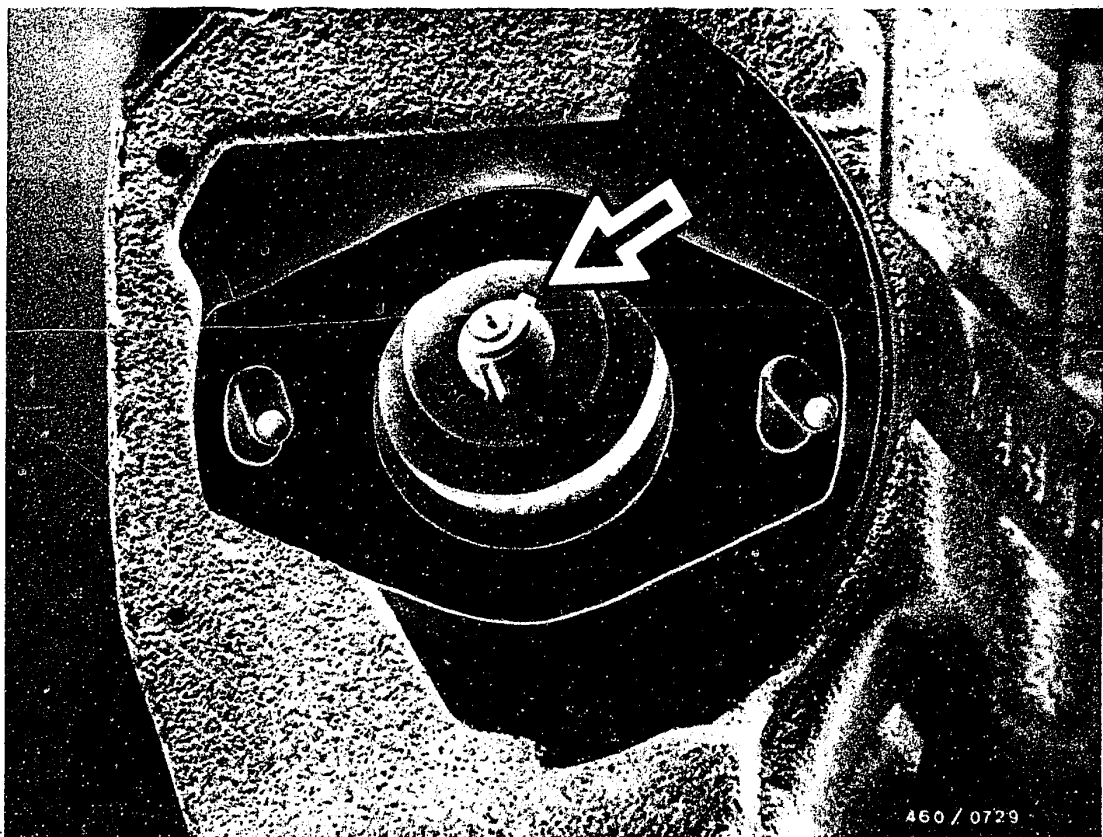
By screwing in the press-out screw (Fig. b, arrow) press injection-pump drive shaft out of drive gear.

Remove injection pump from engine, paying attention to shim ring.

Note:

With the holding device mounted, do not change position of crankshaft.





460 / 0729

5. Install fuel-injection pump

Turn injection-pump drive shaft until keyway points toward outlet "A". Install injection pump so that keyway fits into upper keyseat (arrow) of drive gear.

When inserting the injection pump, pay attention to shim ring.

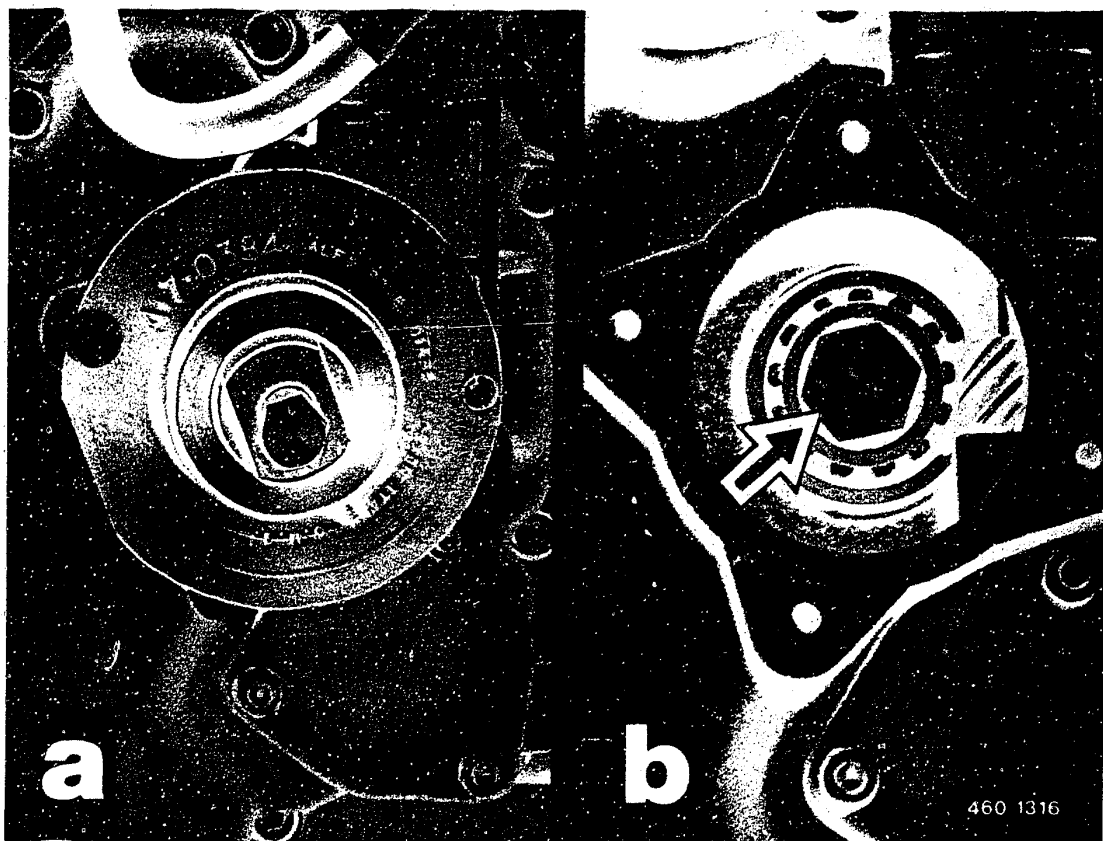
Note on installation

To facilitate installation, position plain washer and spring lock washer of rear stay bolt on pump flange with grease.

Pivot injection pump into center position of slots.

Screw on fastening nuts and finger-tighten.





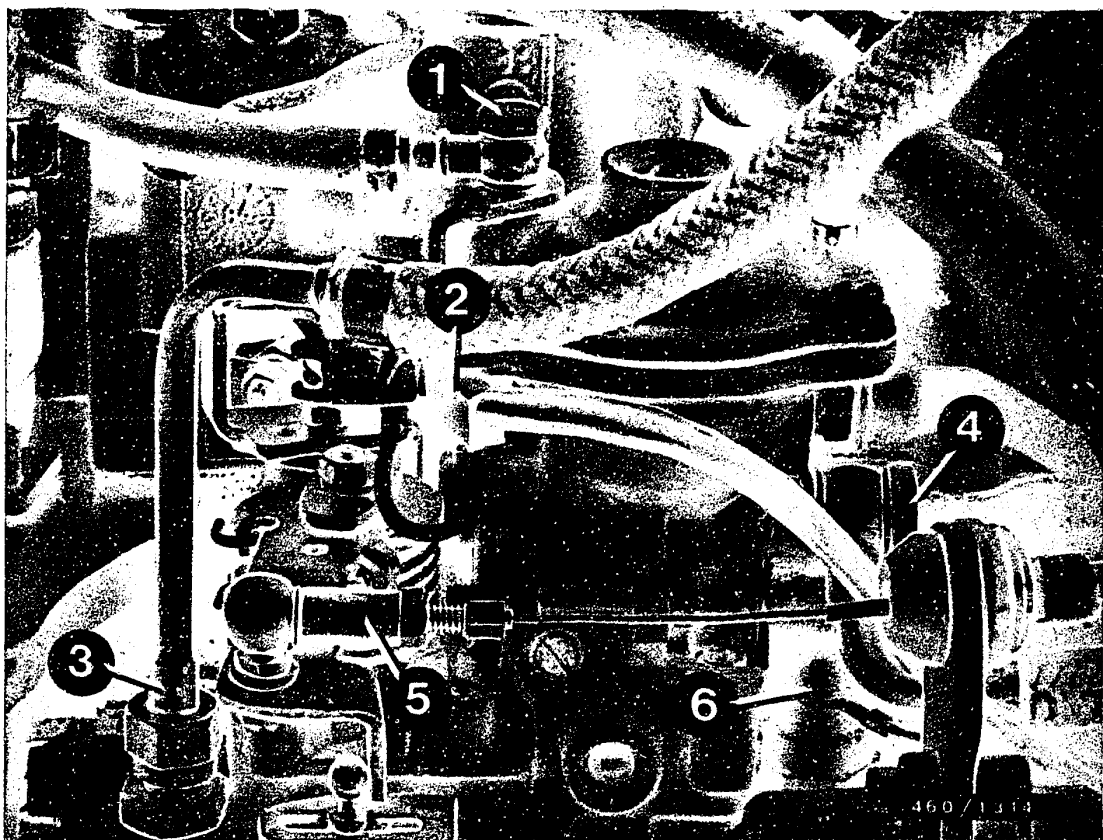
Remove holding and press-out device (Fig. a).

Screw in injection-pump gear fastening screw and
tighten to 88 Nm (Fig. b).

Note:

To prevent crankshaft from turning, select gear and
pull on handbrake.

Mount closing cover.



Mount charge-air pressure connection (1), electric lead on microswitch (2), fuel inlet line (3), return line (4), cable on injection-pump control lever (5) and electric lead on solenoid (6).

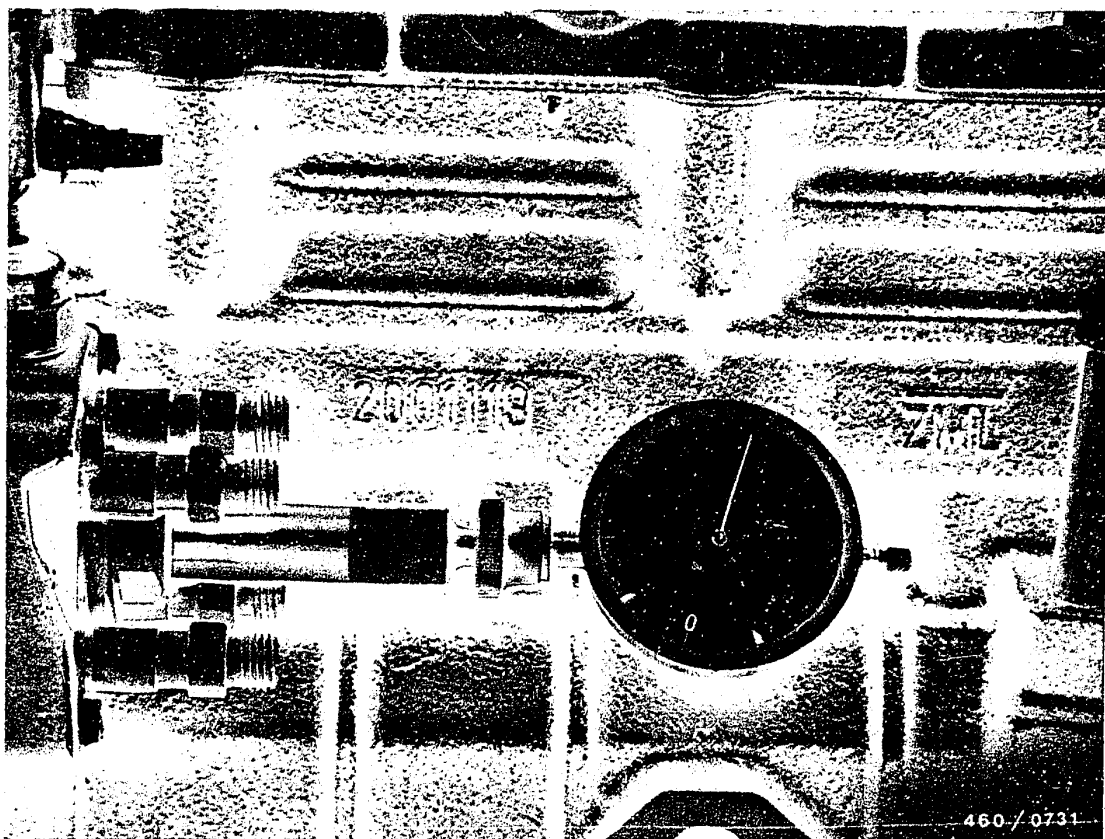
Turn crankshaft in engine direction of rotation until mark on pulley aligns with TDC mark on timing case.

Note:

The inlet-union screws of the fuel inlet and return lines must not be mixed up.

The inlet-union screw of the return is provided with restriction bores and the head of the screw is marked "OUT".





Unscrew bleeder screw out of central screw plug (triangular plug) of hydraulic head.

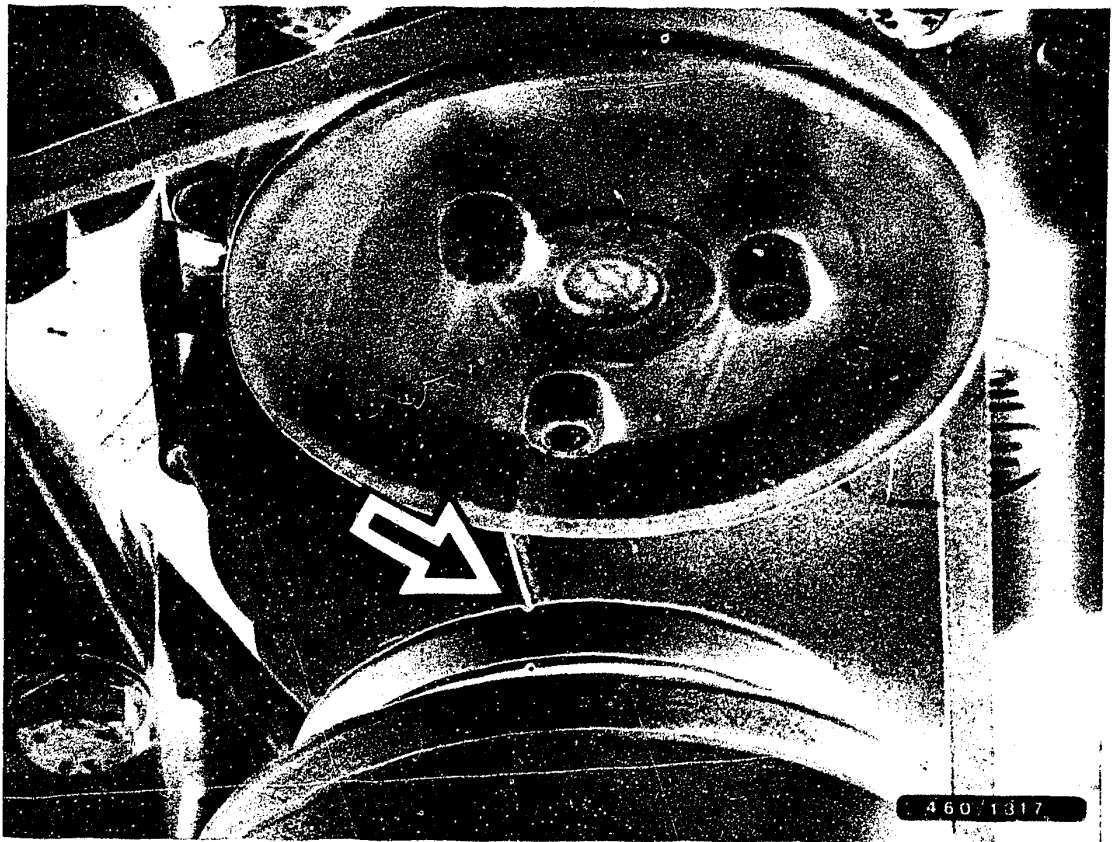
Mount measuring tool KDEP 1085 or 1126 in this bore with dial indicator e.g. 1 687 233 011 and preload by approx. 2 mm.

Turn crankshaft against engine direction of rotation until pointer of dial indicator no longer moves. Set dial indicator to "0".

Note:

When testing and adjusting the start of delivery the cold-start accelerator (KSB) must be in the zero position.





Turn crankshaft in engine direction of rotation until mark on pulley aligns with TDC mark on timing case (see picture-arrow).

With the crankshaft in this position, the dial indicator on the injection pump must indicate a pump plunger stroke of 0.78 ... 0.80 mm after BDC.

If necessary, correct by pivoting the injection pump.



Tighten fastening screws to 25 Nm.

Remove measuring tool KDEP 1085 or 1126 with dial indicator.

Mount bleeder screw with new seal ring.

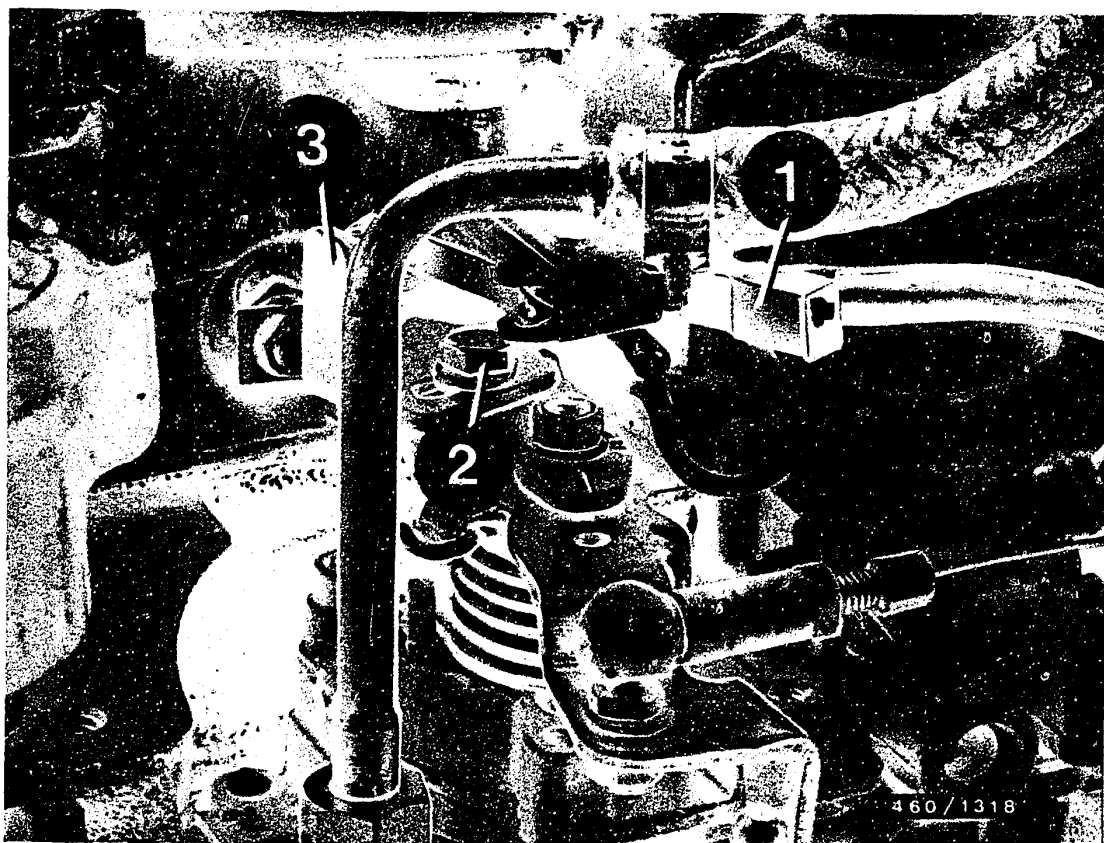
Tighten injection lines with box wrench KDEP 1115 (prevent delivery-valve holders from turning by holding with a wrench).

Connect coolant lines to injection-pump control devices. Mount hose binders and remove hose clampers.

Mount cylinder-head cover.

Install battery.





1 = Plug connector
2 = Hexagon screw

3 = Switching bracket

Adjust microswitch for switching off preheating system

Make sure of the following:

- Idle speed adjusted.

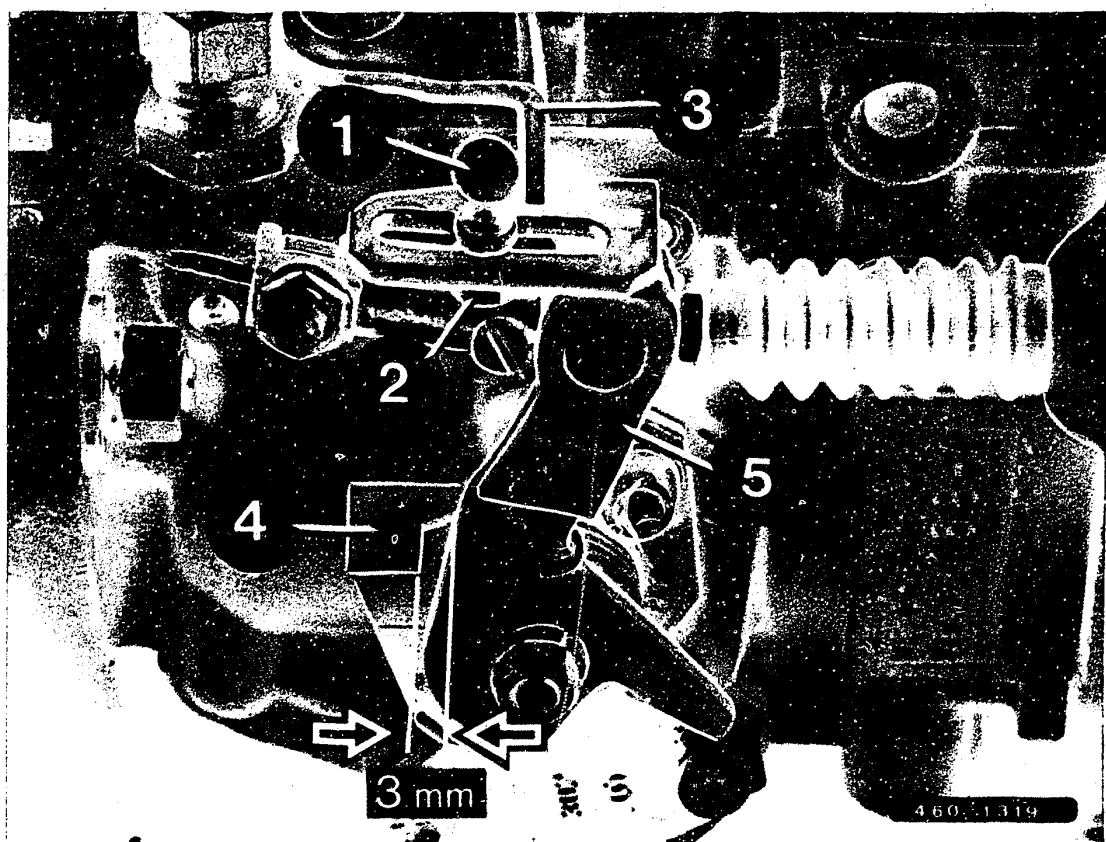
Insert a spacer of 5.5 mm between control lever and idle-stop screw.

Disconnect plug connector from microswitch. Connect test lamp to free terminal of microswitch and positive terminal of battery. Loosen hexagon screw and, by sliding the switching bracket, adjust microswitch switching point.

Note:

This adjustment guarantees that the glow plugs switch off in the post-heating phase above 1300...1900 min⁻¹.





- | | |
|-------------------------|-------------------------------------|
| 1 = Ball head | 4 = Stop |
| 2 = Hexagon nut | 5 = Control lever (cam-roller ring) |
| 3 = Speed-control lever | |

Adjust idle increase

Make sure of the following:

- Idle speed adjusted
- Coolant temperature min. 40°C

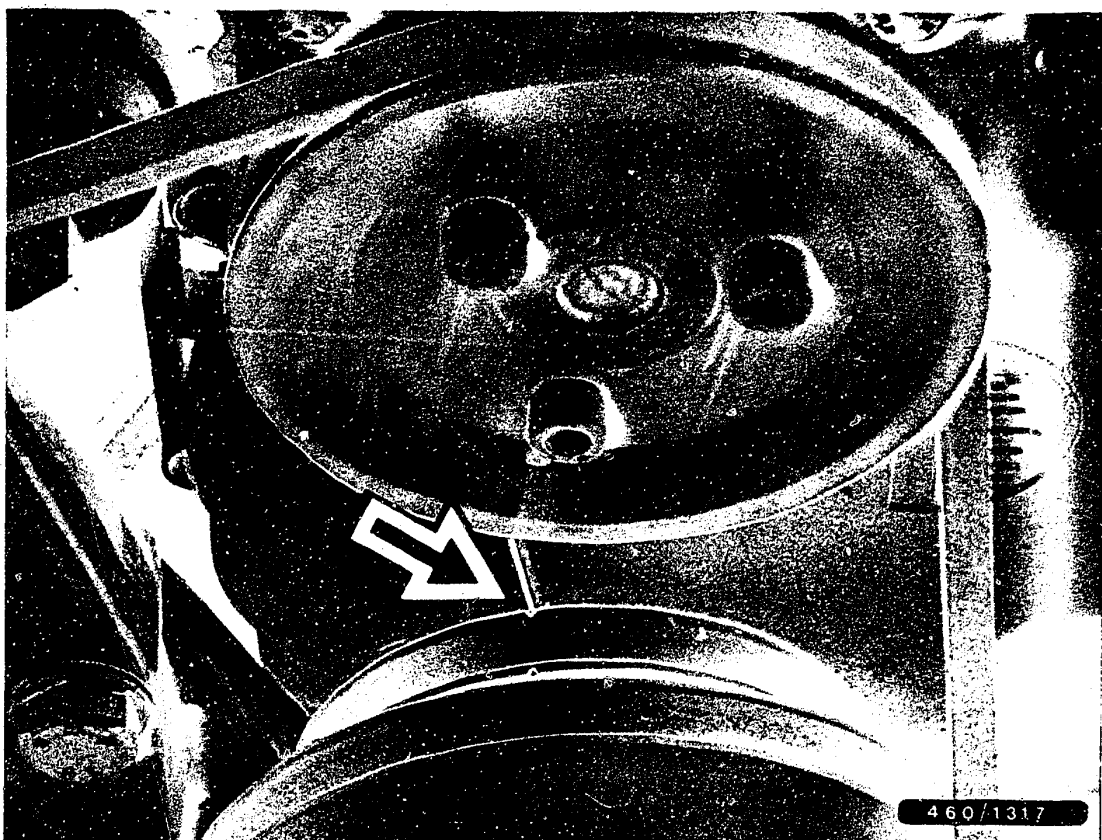
Unhook throttle cable from control lever.

Insert spacer of 3 mm between control lever and stop.

Start engine and run at 1000...1100 min⁻¹.

Loosen hexagon nut and bring ball head up against control lever. Tighten hexagon nut. Remove spacer and mount throttle cable.





6. Injection timing

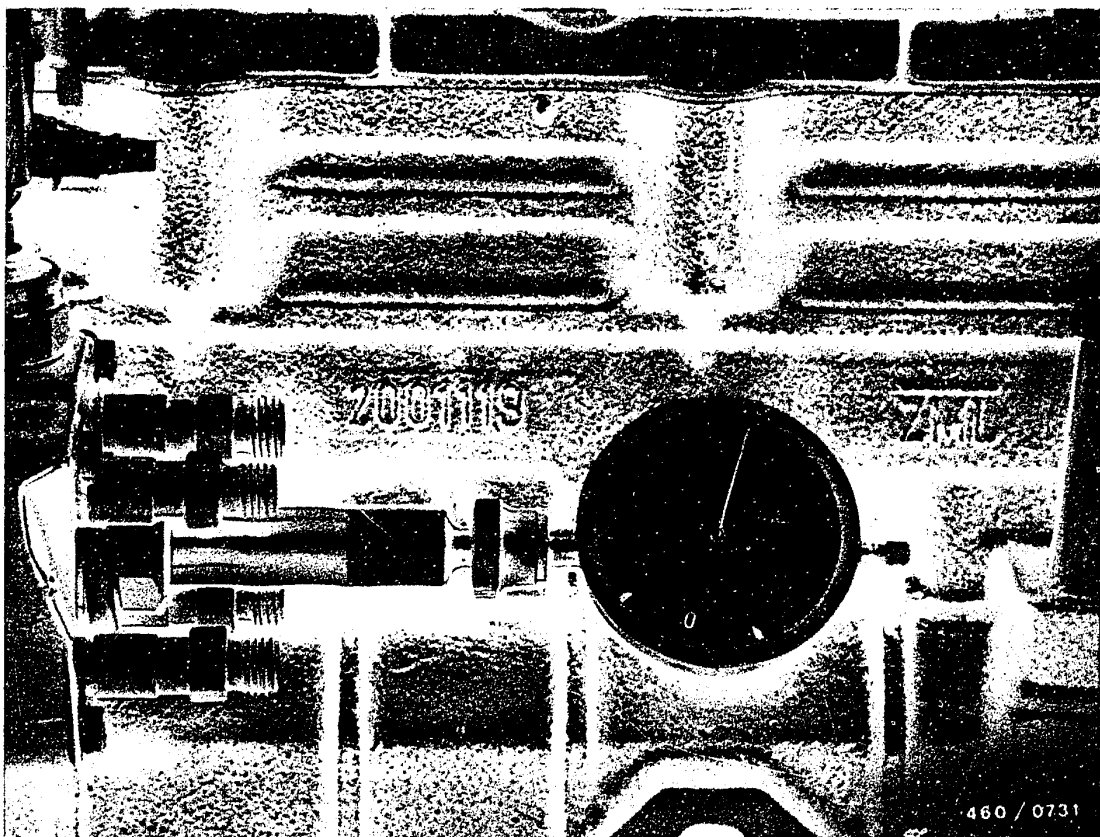
Remove cylinder head cover.

Turn crankshaft to TDC on cylinder 1 (timing gear end).

Mark on timing case must align with pulley mark (see picture-arrow).

When checking and adjusting the start of delivery, the temperature-controlled cold-start accelerator must be in the zero position.





Remove injection lines from injection pump and nozzle-holder assemblies (prevent delivery-valve holders from coming loose by holding with a wrench).

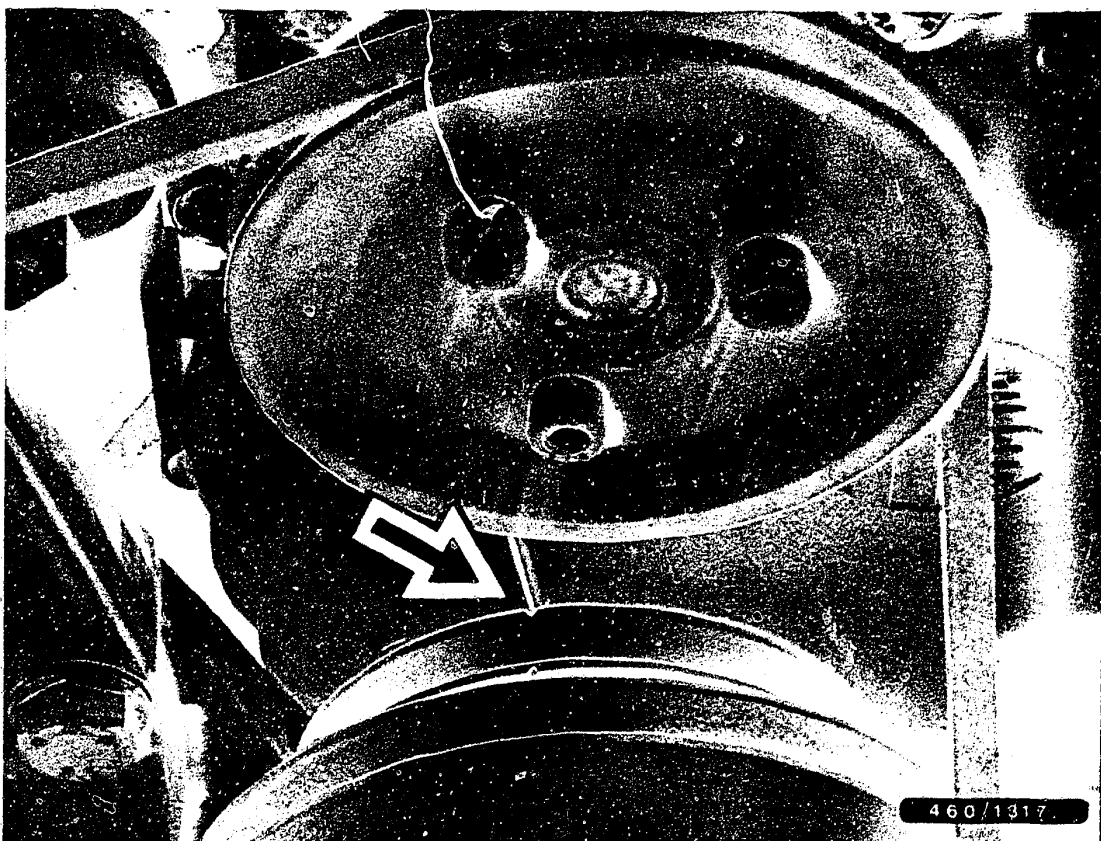
Unscrew bleeder screw from central screw plug (triangular screw) of hydraulic head.

Mount measuring tool KDEP 1085 or 1126 in this bore.

Insert dial indicator (e.g. 1 687 233 011) and pre-load by approx. 2 mm.

Turn crankshaft against engine direction of rotation until the pointer of the dial indicator no longer moves.





Set dial indicator to "0".

Turn crankshaft in engine direction of rotation until mark on pulley aligns with TDC mark on timing case (see picture-arrow).

With the crankshaft in this position, the dial indicator on the injection pump must indicate a pump plunger stroke of 0.78 ... 0.80 mm after BDC.

If necessary, correct by pivoting the injection pump.



If necessary, make correction by pivoting the injection pump.

Tighten fastening screws to 25 Nm.

Remove measuring tool KDEP 1085 or 1126 with dial indicator.

Mount bleeder screw with new seal ring.

Tighten injection lines with box wrench KDEP 1115 (prevent delivery-valve holders from turning by holding with a wrench).

Mount cylinder head cover.



7. Test charge-air pressure

When working on the turbocharger remember that even the smallest particles of dirt can lead to the destruction of the turbocharger.

Therefore, never operate the engine without air filter.

For testing the charge-air pressure it is possible to use pressure tester KDJE-P 100 or a pressure gauge 0 ... 16 bar (e.g. Wika No. 4184).

The charge-air pressure can be measured either with the vehicle stationary or while driving.

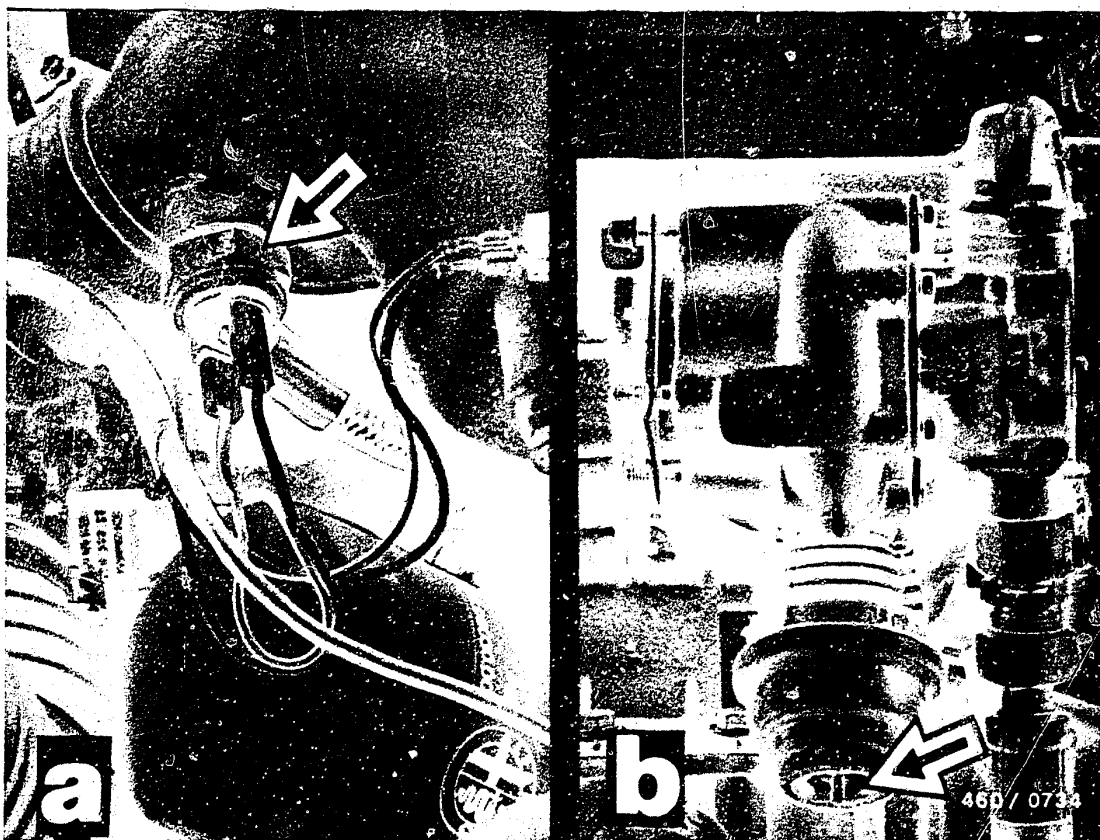
Charge-air pressure measurement

Note:

In order to assess the exhaust-gas turbocharger make sure of the following: Engine at normal operating temperature, start of delivery and nozzle-opening pressure correctly set, air-intake side and exhaust side without leaks, mechanical condition of engine (valve clearance, compression pressure) O.K.

After installing a new turbocharger, fill turbocharger with oil and allow engine to idle for approx. 1 minute so that there is a guaranteed supply of oil to the turbocharger.





Mounting the pressure tester for measuring charge-air pressure

Remove pressure switch from charge-air tube (Fig. a, arrow).

Screw in fitting 12 x 1.5 and establish connection to pressure gauge by means of commercially available hose.

- Charge-air pressure measurement with vehicle stationary without load

At 4000 min⁻¹ 0,39 ... 0,40 bar.

- Charge-air pressure measurement while driving at load

At maximum speed max. 0.88 bar

Charge-air pressure too high/low (no leaks)

Adjust or, if necessary, replace wastegate (Fig. b, arrow).



TABLE OF CONTENTS

Section

Coordinates

1. Test specifications D 2
2. Test conditions D 2
3. Rapid diagnosis chart D 4
4. Electrical terminal diagram D 18
5. Installation position of components .. D 20
6. Necessary test equipment and tools ... D 22
7. Differential locks D 24



1. TEST SPECIFICATIONS

For reasons of safety, the ABS must only be tested with the ABS tester.

The rapid diagnosis chart contains all important test specifications as well as instructions on testing and trouble-shooting.

2. TEST CONDITIONS FOR TESTING WITH ABS TESTER

- The tester must have been converted to the latest technical level (identification "U2" on nameplate or as of FD 352).
- Test ground connection of return pump for security.
- Test hydraulic connections and joints on hydraulic modulator for leaks (visual examination).
- If, while driving, the ABS indicator lamp comes on occasionally (e.g. after switching on loads) and goes out again by itself, check battery and power supply (generator, regulator and voltage drops).
- If the ABS indicator lamp lights up continuously and does not go out, test the following points:
 - Multi-pin plug correctly attached to controller?
Latched?
All plug-in contacts O.K.? Spring contacts latched?
 - V-belt broken? (Generator not supplying any voltage, charge indicator lamp and ABS indicator lamp lit).
 - Generator term. 61 delivering voltage?
Plug connector and cable to ABS controller O.K.?
 - Pay particular attention to testing for loose contacts on wheel-speed sensors with program switch in position 10.



- For testing with tester, switch on ignition in all program switch positions (tester operates on power supply from vehicle battery)
- Note tester lamps 1 and 2 in all program switch positions.

Caution

Do not drive with tester connected

Whenever repairs have been carried out, repeat the entire test program.

General note on trouble-shooting

Test all leads for short circuit to ground and contact with positive leads. Watch for worn leads and pinching.

- Connect ABS tester to controller and ABS wiring harness.

Caution

Disconnect and connect controller only with ignition off.

The installation position of the controller is in the luggage compartment, rear right, behind a cover.



3. RAPID DIAGNOSIS CHART FOR ABS TESTER

Switch on ignition in all program switch positions. Differential locks must be off.

<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specification (reading)</u>	<u>Cause of trouble</u>
1 ... 24	Power supply in each test step	-----	Lamp 1 (green) must be lit for each test step.	<ul style="list-style-type: none"> ● Battery insufficiently charged. Repeat test step with engine running. ● High voltage drops across terminals (e.g. ground terminal). ● ABS cut-off relay, ABS step-by-step relay or overvoltage protection relay defective. ● Open circuit in ground connection
1	Valve relay off position	-----	Lamp 1 (green) and lamp 3 (green) must be lit.	<ul style="list-style-type: none"> ● Leads to valve relay have open circuit or high contact resistance. ● Valve relay defective.
2	Valve relay operating	-----	Lamp 1 (green) and lamp 3 (green) must be lit.	
3	Return-pump relay off position	-----	Lamp 1 (green) and lamp 3 (green) must be lit.	<ul style="list-style-type: none"> ● Leads to return-pump relay have open circuit or high contact resistance. ● Return-pump relay defective. ● Test pump motor for continuity.
4	Return-pump relay operating	Press illuminated key	Lamp 1 (green) and lamp 3 (green) must be lit. Pump motor operating.	

D4

Rapid diagnosis chart

Audi Quattro, Audi 80 Quattro


D5

Rapid diagnosis chart

Audi Quattro, Audi 80 Quattro



<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specification (reading)</u>	<u>Cause of trouble</u>
5	Overvoltage protection relay (only built-in fuse and uni-directional-breakdown diode)	Switch off ignition. Disconnect controller. Connect overvoltage protection relay from vehicle in socket on tester. Connect new overvoltage protection relay in vehicle. Switch on ignition. Press illuminated key.	Lamp 1 (green) and lamp 3 (green) must be lit.	<ul style="list-style-type: none"> The overvoltage protection relay in the socket on the tester is defective.
6	Internal resistances of solenoid-operated valves in hydraulic modulator	Switch off ignition. Reconnect controller. Switch on ignition. Press key FL Press key FR Press key RA	Lamp 1 (green) must be lit. FL: 0.7 ... 1.7 Ω FR: 0.7 ... 1.7 Ω RA: 0.7 ... 1.7 Ω	<ul style="list-style-type: none"> Leads to valve in question have open circuit or high contact resistance. Hydraulic modulator defective.
7	Ground connection to term. 10	Press illuminated key	Lamp 1 (green) must be lit. 80 ... 300 mV	<ul style="list-style-type: none"> Ground lead and ground terminal have open circuit or high contact resistance
8	Ground connection to term. 34	Press illuminated key	Lamp 1 (green) must be lit. 30 ... 250 mV	
9	Ground connection to term. 20	Press illuminated key	Lamp 1 (green) must be lit. 30 ... 250 mV	

D6

Rapid diagnosis chart

Audi Quattro, Audi 80 Quattro

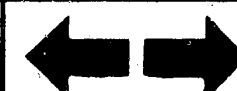

D7

Rapid diagnosis chart

Audi Quattro, Audi 80 Quattro



<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specification (reading)</u>	<u>Cause of trouble</u>
10	Internal resistances of wheel-speed sensors	Press key FL Press key FR Press key RL Press key RR	Lamp 1 (green) must be continuously lit. FL: 0.8 ... 1.8 kΩ FR: 0.8 ... 1.8 kΩ RL: 0.8 ... 1.8 kΩ RR: 0.8 ... 1.8 kΩ	<ul style="list-style-type: none"> • Test for loose contact: move all leads at fastening points, on plug and on wheel-speed sensor and watch reading. • Leads to wheel-speed sensor in question have open circuit or high contact resistance. • Wheel-speed sensor in question defective.
11	Insulation resistances of wheel-speed sensors	Press key FL Press key FR Press key RL Press key RR	Lamp 1 (green) must be continuously lit. FL: 20 ... 999 kΩ FR: 20 ... 999 kΩ RL: 20 ... 999 kΩ RR: 20 ... 999 kΩ	<ul style="list-style-type: none"> • Test leads to wheel-speed sensor in question for insulation damage. • Wheel-speed sensor in question defective.
12	DC voltage on wheel-speed sensor leads	Press key FL Press key FR Press key RL Press key RR	Lamp 1 (green) must be continuously lit. FL: 000 ... 100 mV FR: 000 ... 100 mV RL: 000 ... 100 mV RR: 000 ... 100 mV	<ul style="list-style-type: none"> • Check leads to wheel-speed sensor in question for contact (worn lead) with a positive lead. • Wheel-speed sensor in question defective.
13	Controller internal supply voltage	Press illuminated key	4.75 ... 5.25 V	<ul style="list-style-type: none"> • Controller defective.



<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specification (reading)</u>	<u>Cause of trouble</u>
14	Diode in forward direction and ABS indicator lamp		0.4 ... 1.5 V ABS indicator lamp in vehicle must be lit.	<ul style="list-style-type: none"> Leads to diode/indicator lamp have open circuit or contact resistance. Indicator lamp defective. Diode (hydraulic modulator) defective.
15	Diode in reverse direction		2.5 ... 8.5 V ABS indicator lamp slightly dimmer	<ul style="list-style-type: none"> Diode (hydraulic modulator) defective.
16	Controller BITE* triggering	Press illuminated key for 3 seconds	Indicator lamp must go out after max. 1 second.	<ul style="list-style-type: none"> Controller defective
17	Controller, BITE* fault simulation	Press illuminated key for 3 seconds	Indicator lamp must remain lit (flickering allowable).	<ul style="list-style-type: none"> Controller defective.
18	deleted			
19	Controller, current for pressure reduction	Press key FL, press illuminated key Press key FR, press illuminated key Press key RA, press illuminated key	FL: 4.5 ... 6.0 A FR: 4.5 ... 6.0 A RA: 4.5 ... 6.0 A	<ul style="list-style-type: none"> Controller defective
24	Voltage from stop-lamp switch	Press brake pedal	10 ... 15 V	<ul style="list-style-type: none"> Lead to stop-lamp switch defective. Stop-lamp switch defective. Stop lamps defective.

* BITE = Built-in test circuit

D10

Rapid diagnosis chart

Audi Quattro, Audi 80 Quattro



D11

Rapid diagnosis chart

Audi Quattro, Audi 80 Quattro



A dynamic brake analyzer is required for program switch positions 20, 21, 22 and 23.

Do not drive with tester connected.

Do not use a brake-pedal actuating device for setting the braking force.

Program switch position 23 must come first.

Front axle

Drive front wheels of vehicle onto dynamic brake analyzer. Pull on handbrake.

On vehicles with automatic transmission, set selector lever to position "N".

<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specification (reading)</u>	<u>Cause of trouble</u>
23	Wheel-speed sensor signal	Press key FL, switch on left-hand brake roller. Press key FR, switch off left-hand brake roller, switch on right-hand brake roller	<u>FL: 1.7 ... 19</u> <u>FR: 1.7 ... 19</u>	<ul style="list-style-type: none"> • Wheel-speed sensors mixed up? • Air gap too big. • Wheel-speed sensor in question defective.
20	Hydraulic modulator pressure reduction	Press key FR. Switch on right-hand brake roller. Press brake pedal and hold constant at 2000 N. Press illuminated key. Press key FL. Switch off right-hand brake roller. Switch on left-hand brake roller. Keep constant at 2000 N with brake pedal. Press illuminated key.	<u>FR: less than 1100 N</u> <u>FL: less than 1100 N</u>	<ul style="list-style-type: none"> • Brake lines mixed up? • Conventional brake system O.K.? • Hydraulic modulator defective. <p><u>Note:</u> Exchange hydraulic modulator only as a complete unit. Repair not allowed. Danger!</p>
21	Hydraulic modulator pressure buildup	Press key FL. Switch on both brake rollers. Press brake pedal and hold constant at 2000 N. Press illuminated key.	Left-hand reading on dynamic brake analyzer moves to an intermediate value and rises again to <u>FL: 600 ... 1500 N</u>	

D12

Rapid diagnosis chart

Audi Quattro, Audi 80 Quattro



D13

Rapid diagnosis chart

Audi Quattro, Audi 80 Quattro



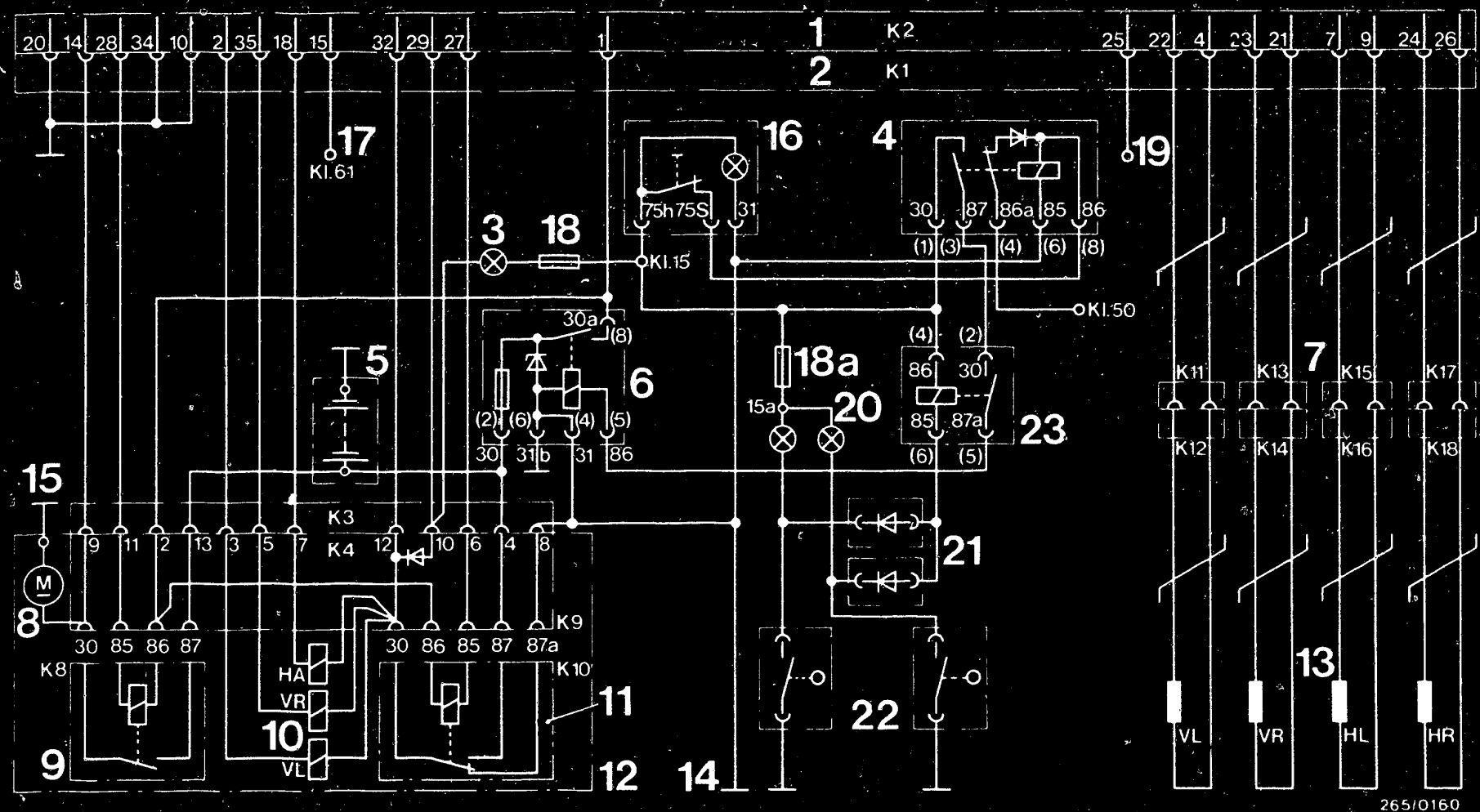
<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specification (reading)</u>	<u>Cause of trouble</u>
21	Hydraulic modulator pressure buildup	Press key FR. Switch on both brake rollers. Press brake pedal and hold constant at 2000 N. Press illuminated key.	Right-hand reading on dynamic brake analyzer moves to an intermediate value and rises again to <u>FR: 600 ... 1500 N.</u>	<ul style="list-style-type: none"> ● Brake lines mixed up? ● Conventional brake system O.K.? ● Hydraulic modulator defective. <p><u>Note:</u> Exchange hydraulic modulator only as a complete unit. Repair not allowed. Danger!</p>
22	Hydraulic modulator pump delivery	Switch on brake rollers. Read off natural friction value. Press key FR. Press brake pedal and hold constant at <u>2000 N.</u> Press illuminated key.	After an intermediate value on right return pump cuts in briefly. Right-hand reading must drop below <u>natural friction value plus 200 N.</u> Reading rises only briefly.	<ul style="list-style-type: none"> ● Hydraulic modulator defective. <p><u>Note:</u> Exchange hydraulic modulator only as a complete unit. Repair not allowed. Danger!</p>
<u>Rear axle</u> 23	Wheel-speed sensor signal	Drive rear wheels of vehicle onto dynamic brake analyzer. Press key RL. Switch on left-hand brake roller. Press key RR. Switch off left-hand brake roller. Switch on right-hand brake roller.	<u>RL: 1.7 ... 19</u> <u>RR: 1.7 ... 19</u>	<ul style="list-style-type: none"> ● Wheel-speed sensors mixed up? ● Air gap too big. ● Wheel-speed sensor in question defective.



<u>Program switch position</u>	<u>Testing of</u>	<u>Additional operation</u>	<u>Test specification (reading)</u>	<u>Cause of trouble</u>
20	Hydraulic modulator pressure reduction	Press key RA. Switch on both brake rollers. Press brake pedal and hold constant at <u>1500 N</u> . Press illuminated key.	RA: <u>less than 800 N</u>	<ul style="list-style-type: none"> ● Brake lines mixed up? ● Conventional brake system. O.K.? ● Hydraulic modulator defective. <p>Note: Exchange hydraulic modulator only as a complete unit. Repair not allowed. Danger!</p>
21	Hydraulic modulator pressure buildup	Press key RA. Switch on both brake rollers. Press brake pedal and hold constant at <u>1500 N</u> . Press illuminated key.	Both readings on dynamic brake analyzer move to an intermediate value and rise again to RA: <u>400...1100 N</u> .	
22	Hydraulic modulator pump delivery	Switch on brake rollers. Read off natural friction value. Press key RA. Press brake pedal and hold constant at <u>1500 N</u> .	After an intermediate value on both sides return pump cuts in briefly. Reading on both sides must drop below <u>natural friction value plus 200 N</u> . Reading rises only briefly.	<ul style="list-style-type: none"> ● Hydraulic modulator defective. <p>Note: Exchange hydraulic modulator only as a complete unit. Repair not allowed. Danger!</p>

As a final test, conduct a road test.
With engine running indicator lamp must go out. Drive at least 30 km/h.
Indicator lamp must not come on again.





4. ELECTRICAL TERMINAL DIAGRAM FOR ABS

- | | | |
|---|--|---|
| 1 = Electronic controller | 12 = Hydraulic modulator | 20 = Indicator lamps for differential locks |
| 2 = Multiple plug (35-pin) | 13 = Wheel-speed sensors | 21 = Diode connector |
| 3 = ABS indicator lamp | 14 = Ground terminal behind instrument panel | 22 = Switches for differential locks |
| 4 = Relay for controller (step-by-step relay) | 15 = Ground terminal in eng. comp. on left | 23 = ABS cut-off relay |
| 5 = Battery | 16 = ABS switch | VL = Front left |
| 6 = Overvoltage protection relay | 17 = to alternator | VR = Front right |
| 7 = Cable connector | 18 = Fuse in relay board with fuse holder | HL = Rear left |
| 8 = Return-pump motor | 18a = Fuse no. 12 (15A) in central-electrics console | HR = Rear right |
| 9 = Return-pump relay | 19 = to stop-lamp switch | HA = Rear axle |
| 10 = Solenoid-operated valves | | K1, K2 etc. = Plug numbers |
| 11 = Valve relay | | |

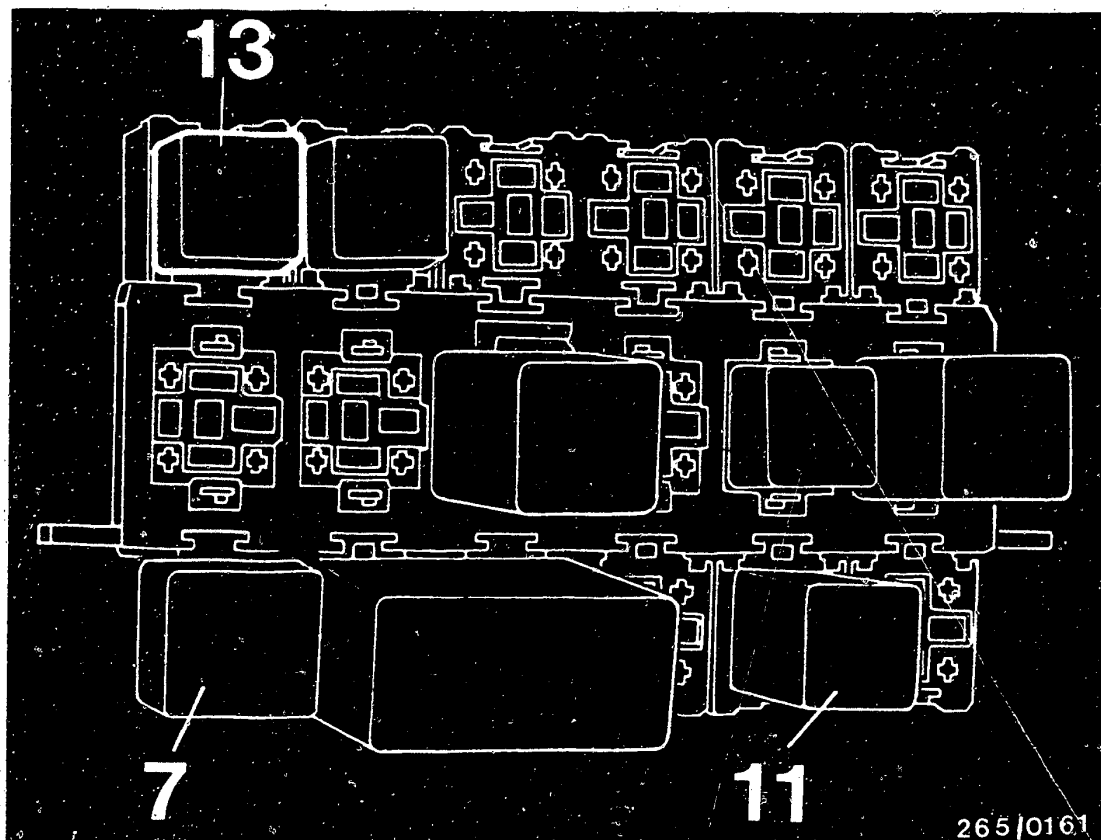


5. INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" always refer to the forward direction of travel.

- ABS indicator lamp: in instrument panel.
- ABS switch: in instrument panel.
- Front-axle wheel-speed sensors: in steering knuckles on left and right.
- Rear-axle wheel-speed sensors: near brake callipers on left and right.
- Hydraulic modulator: in engine compartment on left in front of brake master cylinder.
- Ground terminal for ABS: on bracket for hydraulic modulator.
- Controller: in luggage compartment, rear right, behind a cover.
- Switches for differential locks: one each in housings for centre and rear axle differential locks.
- Diode connector: under instrument panel, near relay panel.





265/0161

- Relay for controller (step-by-step relay):
Under instrument panel on left in relay panel, relay location 7
- Overvoltage protection relay:
Under instrument panel on left in relay panel, relay location 11
- ABS cut-off relay for differential lock:
Under instrument panel on left in relay panel, relay location 13



6. TEST EQUIPMENT AND TOOLS

Description	Designation	Part No.
<u>ABS tester</u> Use only converted testers. Identification "U2" on nameplate or as of FD 352.	ETT 016.00	0 684 101 600
<u>Adapter cable</u> for connection of overvoltage protection relay		1 684 460 120
Dynamic brake analyzer	e.g. BPS 100 or BPS 101 or BPS 104 or BPS 105	0 680 012 .. 0 680 013 .. 0 680 018 .. 0 680 019 ..
<u>Charging and bleeding device</u>		e.g. ATE Part No. 3.9302.1000.4 1)
<u>Bleeder connection</u> for connecting charging and bleeding device to fluid reservoir of master cylinder		ATE Part No. 3.9302.0702.2 1)
<u>Bleeder hose</u>		ATE Part No. 3.3590.2300.1 1)
<u>Auxiliary hose</u>		ATE Part No. 3.9302.0704.2 1)
<u>Brake-pedal actuating device</u>		ATE Part No. 3.9312.0100.4 1)

- 1) obtainable from:
 Alfred Teves GmbH
 Guerickestr. 7
 6000 Frankfurt/Main



Description	Designation	Part No.
<u>Pressure tester</u> tester for low and high pressure testing of hydraulic brake systems		e.g. ATE Part No. 3.9305-0200.4 1)
<u>Double-end flare nut</u> <u>wrench, 9 x 11 mm</u>		Hazet Part No. 612 2)
<u>Vessel</u> for catching the brake fluid approx. 1 l <u>Brake fluid</u> Use only ATE genuine brake fluid DOT 4 or VW brake fluid.		
<u>Electrics tester</u> or <u>Multimeter</u> for trouble-shooting	ETE 014.00	0 684 101 400 commercially available

6.1 Auxiliary materials

Use only VW genuine brake lines.

Description	Part No.:
Grease for wheel-speed sensors	Molykote Longterm 2
Protective caps for brake lines	1 900 508 002 (100 pieces)
Protective caps for connection of brake lines to hydraulic modulator	1 900 508 004 (100 pieces)

1) obtainable from:
Alfred Teves GmbH
Guerickestrasse 7
6000 Frankfurt/Main

2) Firma
H a z e t
5630 Remscheid



7. DIFFERENTIAL LOCKS

The vehicles have a centre differential lock and a rear axle differential lock. The locks can be switched on and off by means of a 2-stage push-pull switch. If one of the two stages is selected, the ABS is automatically switched off. The driver can decide whether to drive with ABS or differential lock. By means of the push-pull switch, intake-manifold pressure is applied to a pneumatic actuator which allows the lock in the differential to take effect by way of an operating lever. If the lock is selected, an electrical switch on the differential is mechanically actuated and switches off the power supply to the ABS by way of diodes and a cut-off relay. In addition to the ABS indicator lamp, the indicator lamp for the appropriate differential lock also lights up.

To test the ABS, the differential locks must be off in order to maintain the power supply.



TABLE OF CONTENTS

Section

Coordinates

1. Special features	E 2
2. Test specifications	E 3
3. Electric safety circuit	E 9
4. Fuel line diagram	E 12
5. Idle stabilization	E 14
6. General safety instructions	E 16
7. Installation position of the individual components	E 17



1. Special features:

- K-Jetronic, with lambda closed-loop control
- 35-pole control unit for fully electronic ignition system and lambda closed-loop control.
Equipped with defect memory, display by means of trouble light, and tachometer. (Non-Bosch products)
- Fuel-injection valves with stationary air guide cap for air shrouding. Air distribution in the cylinder head. Adapters KDJE-P 200/19 are required to connect these fuel-injection valves to the tester for comparison of fuel delivery.
- Air-flow sensor with angle sensor (potentiometer) for fuel-consumption display.
- Warm-up regulator with altitude correction.
- In-tank electric fuel pump with pressure damper screwed on for noise reduction.
- Instead of an auxiliary-air device, idle stabilization (non-Bosch product) similar to idle speed control.
- Temperature-controlled auxiliary fan for cooling the fuel-injection valves.
- Exhaust gas turbocharger
- Blowoff valve to control the turbocharger.
- Charge-air cooler after the turbocharger.
- Note:
Essentially, the K-Jetronic in the Audi 5000 Turbo is the same as that in the Audi 5000.
Similar SIS repair instructions:
Microfiche card AUD-506.



2. Test specifications

Test step

Test specifications*

2.1 Electric fuel pump

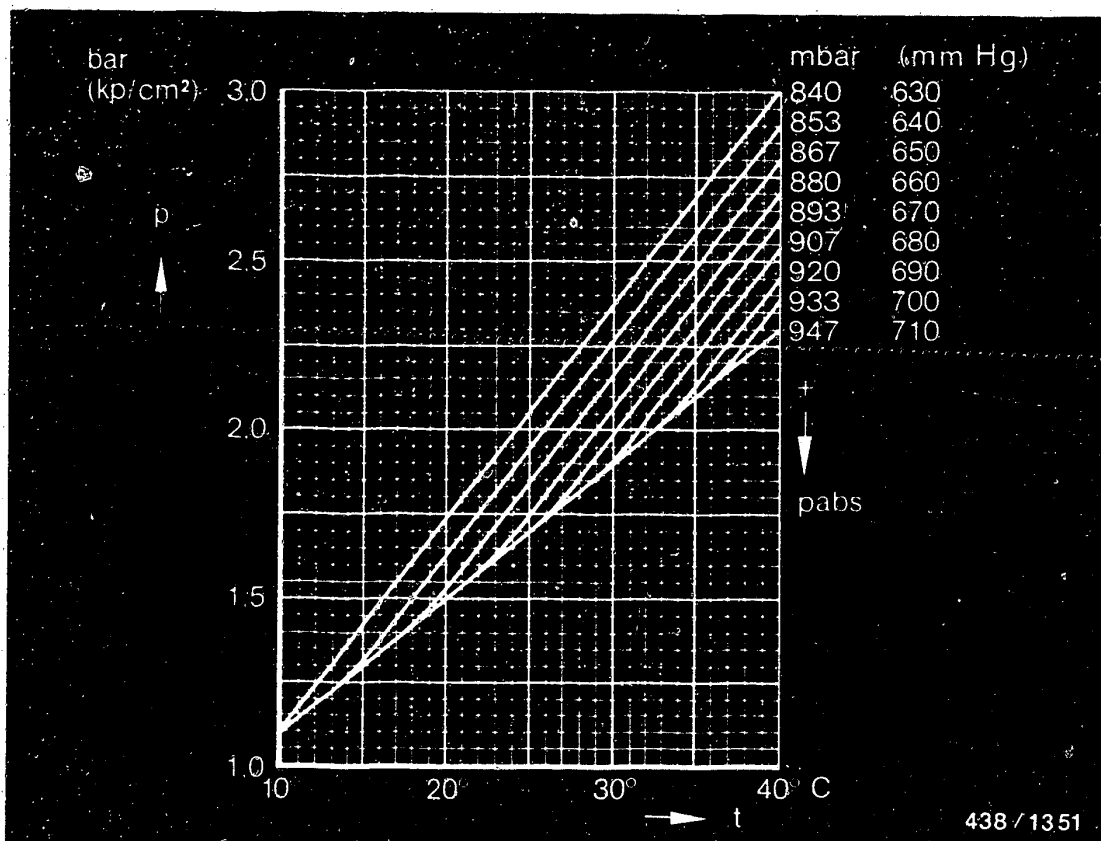
- Fuel delivery: min. 950 cm³/30 s
- Connection voltage: min. 11.5 V under load

2.2 Fuel distributor 0 438 100 136

● Primary pressure	Test specifications:	Settings:
	5.1...5.8 bar (5.2...5.9 kgf/cm ²)	5.3...5.5 bar (5.4...5.6 kgf/cm ²)

* Pressures are indicated in the table of test specifications in bar (gauge pressure) and/or in kgf/cm² (gauge pressure).





p = Control pressure (gauge pressure)
 t = Ambient temperature
 p_{abs} = Air pressure

2.3 Warm-up regulator

Model for altitude compensation 0 438 140 026 / .. 027

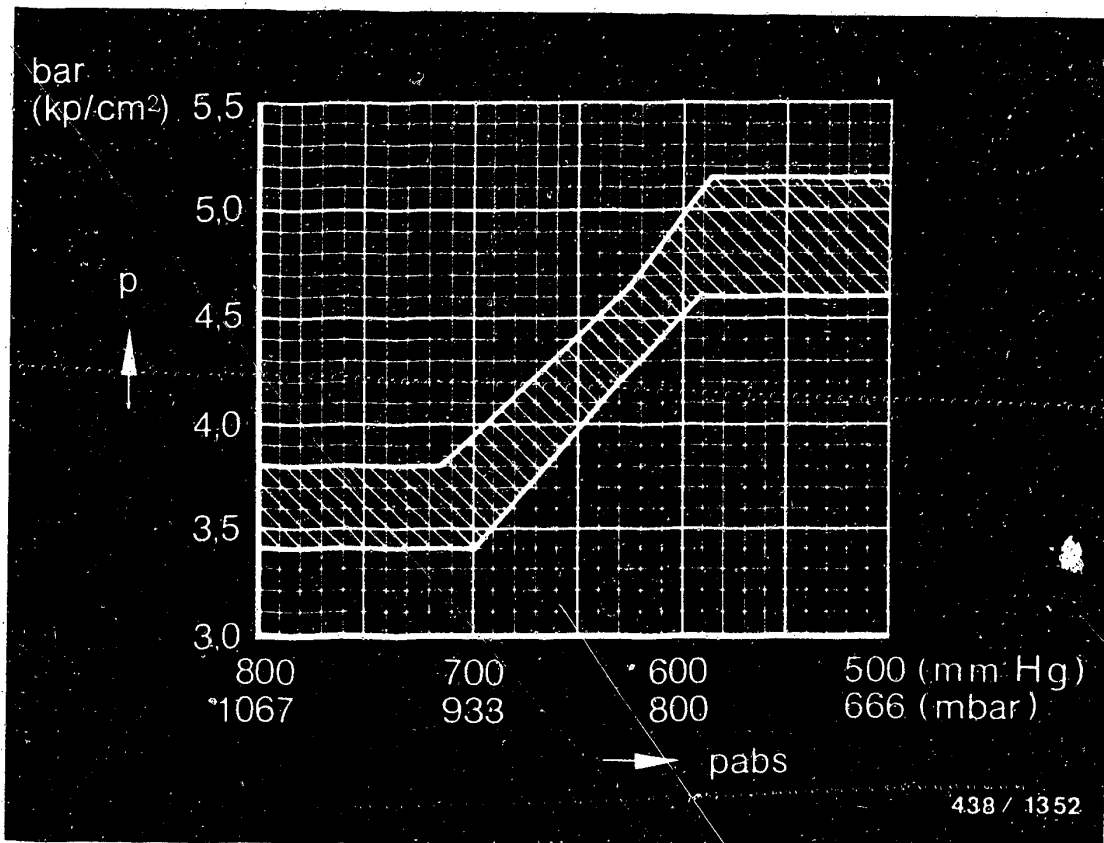
- Fuel delivery for the control pressure circuit: 160 ... 240 cm³/min.
- "Cold" control pressure

Obtain the specified value for control pressure from the diagram to correspond to the ambient temperature and the atmospheric pressure.

The basic curve for the control pressure is subject to a tolerance of ± 0.2 bar.

The altitude curves for the control pressure are subject to a tolerance of ± 0.25 bar.

The basic curve applies for atmospheric pressure greater than 947 mbar (710 mmHg).



p = Control pressure (gauge pressure)
 p_{abs} = Air pressure

● "Warm" control pressure

Warm-up regulator 0 438 140 026/... 027
 (model with altitude compensation)

Measure the control pressure immediately after the warm-up regulator cuts out.

Test step	Test specifications *	
2.4 Fuel accumulator	0 438 170 040 0 438 170 041	
● Test for leaks min. pressure:	after 10 minutes	after 20 minutes
	2.5 bar (2.6 kgf/cm ²)	2.4 bar (2.5 kgf/cm ²)
2.5 Fuel-injection valve	0 437 502 026 0 437 502 027	
● Opening pressure	3.0 ... 4.1 bar (3.1 ... 4.2 kgf/cm ²)	
● Test for leaks: not less than 2.8 bar:	There must not be any dripping within 20 seconds.	

2.6 Fuel distributor 0 438 100 136

- Comparative measurement of fuel deliveries:

	Setting point	Max. allowable fuel delivery
Idle	6.0 cm ³ /min.	6.6 cm ³ /min.
Part load	40.0 cm ³ /min.	43.0 cm ³ /min.
Full load	136.0 cm ³ /min.	150.0 cm ³ /min.
This fuel delivery must be at- tained at a minimum at every outlet.		

* Pressures are indicated in the test specifications
in bar (gauge pressure) and/or kgf/cm² (gauge press-
ure).



Test step

Test specifications

2.7 Thermotime switch

0 280 130 214
0 280 130 223

● Measurement of resistance between

at a temperature below °C	above °C	Term."G" and "ground" (housing)	Term."W" and "ground" (housing)	Term."G" and Term."W"
+30		25...40 Ω	0 Ω	25...40 Ω
	+40	50...80 Ω	100...160 Ω	50...80 Ω

2.8 Idle adjustment*● Idle speed

Air conditioner off 730...870 min⁻¹
Air conditioner on 830...970 min⁻¹

With idle actuator current

Air conditioner off 410...450 mA

Air conditioner on:

Manual transmission 470...510 mA

Automatic transmission 480...520 mA

● CO-level

0.3...1.2 vol.%

with on/off ratio

fluctuating

Test specification

25...65%

Setting

50%

- * To adjust or check idle speed: Switch on the high beam light, switch off the air conditioner. Engine at normal operating temperature, oil temperature approx. +80°C. The fan for the radiator must not be running during the adjustment. Disconnect the overrun cutoff and the exhaust gas recirculation system (if they are there). Disconnect the crankcase ventilation hose from the cylinder head cover and plug the end of the hose.



Test step

Test specifications

2.9 Lambda closed-loop control*

- On/off ratios:

t_0 (lean stop)	max. 20%
t_1 (open-loop control)	45...55%
t_2 (rich stop)	min. 87%
t_3 { warm-up or	75...85%
t_4 { full load enrichment }	60...70%
- Closed-loop control
fluctuating between 25...65%

Timing valve

- Internal electrical re-
sistance at +20°C: 2.0...3.0 Ω
- Lead resistance: 9.0...10.0 Ω

2.10 "Air" temperature sensor

- Internal electrical
resistance: 400...700 Ω

2.11 "Engine" temperature sensor

- Internal electrical re-
sistance: 60...1000 Ω

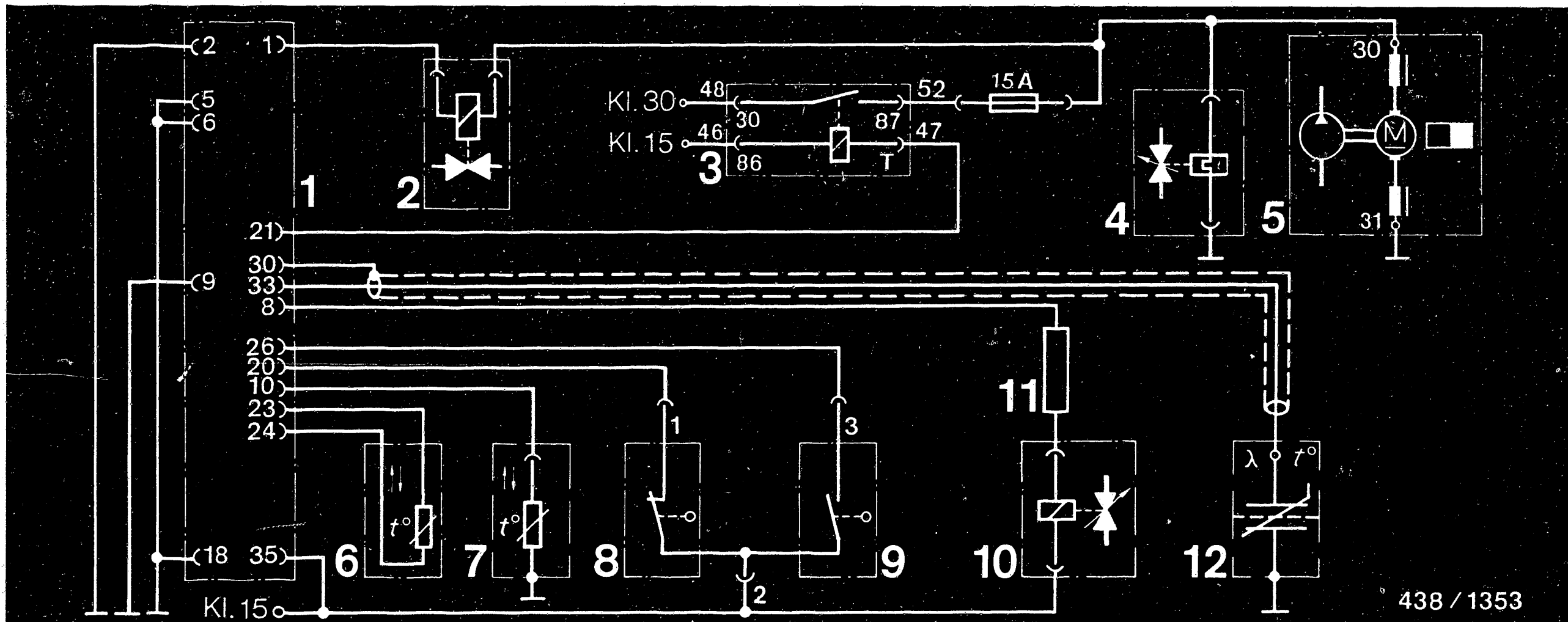
2.12 Potentiometer on the air-flow sensor

- | | |
|----------------------|----------------------|
| Total resistance | 3000...5000 Ω |
| Idle resistance | 500... 900 Ω |
| Full-load resistance | 3500...6000 Ω |

* Functional test and setting of the lambda closed-loop control:

Warm up the engine with the lambda sensor connected. Then disconnect the sensor lead. Adjust the CO-value. Then reconnect the sensor lead. The CO-value must now drop off to max. 1.0%. Checking the on/off ratios: there must be a clear-cut difference in reading between t_2 and t_3 .





438 / 1353

1 = Control unit for ignition and fuel injection

2 = Starting valve

3 = Fuel-injection relay

4 = Warm-up regulator

5 = Electric fuel pump

6 = "Air" temperature sensor

7 = "Engine" temperature sensor

8 = Idle throttle valve switch

9 = Full-load throttle valve switch

10 = Timing valve

11 = Lead resistor

12 = Lambda sensor

Kl. = Term.

3. Electrical safety circuit with control unit (non-Bosch product) for the ignition and fuel-injection

3.1 Wiring diagram

The safety circuit and the fuel-injection relay (3) are triggered by Terminal 21 of the control unit. The following additional functions are also triggered by the control unit: starting enrichment via the starting valve, warm-up enrichment by the "engine" temperature sensor, lambda closed-loop control by the lambda sensor and the timing valve with the lead resistor.

E9

Electrical safety circuit

Audi 5000 Turbo

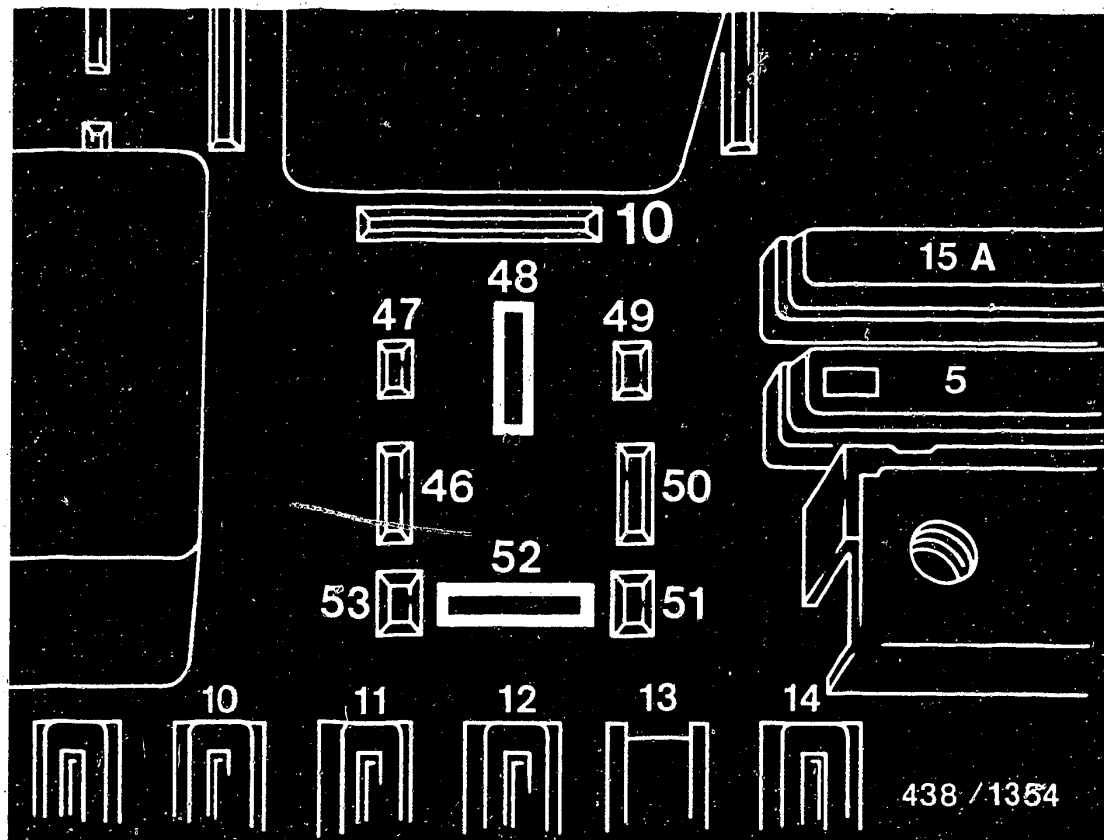


E10

Electrical safety circuit

Audi 5000 Turbo





10 = Location of the fuel-injection relay

3.2 Jump the safety circuit for testing

To do this, pull the fuel-injection relay out of the relay plate. Connect contacts 48 and 52 with a connecting lead. Use a connecting lead with a cross-section 1.5 mm² and a fusing element with a 16 Amp fuse.

Width of the blade terminal: 9.5 mm

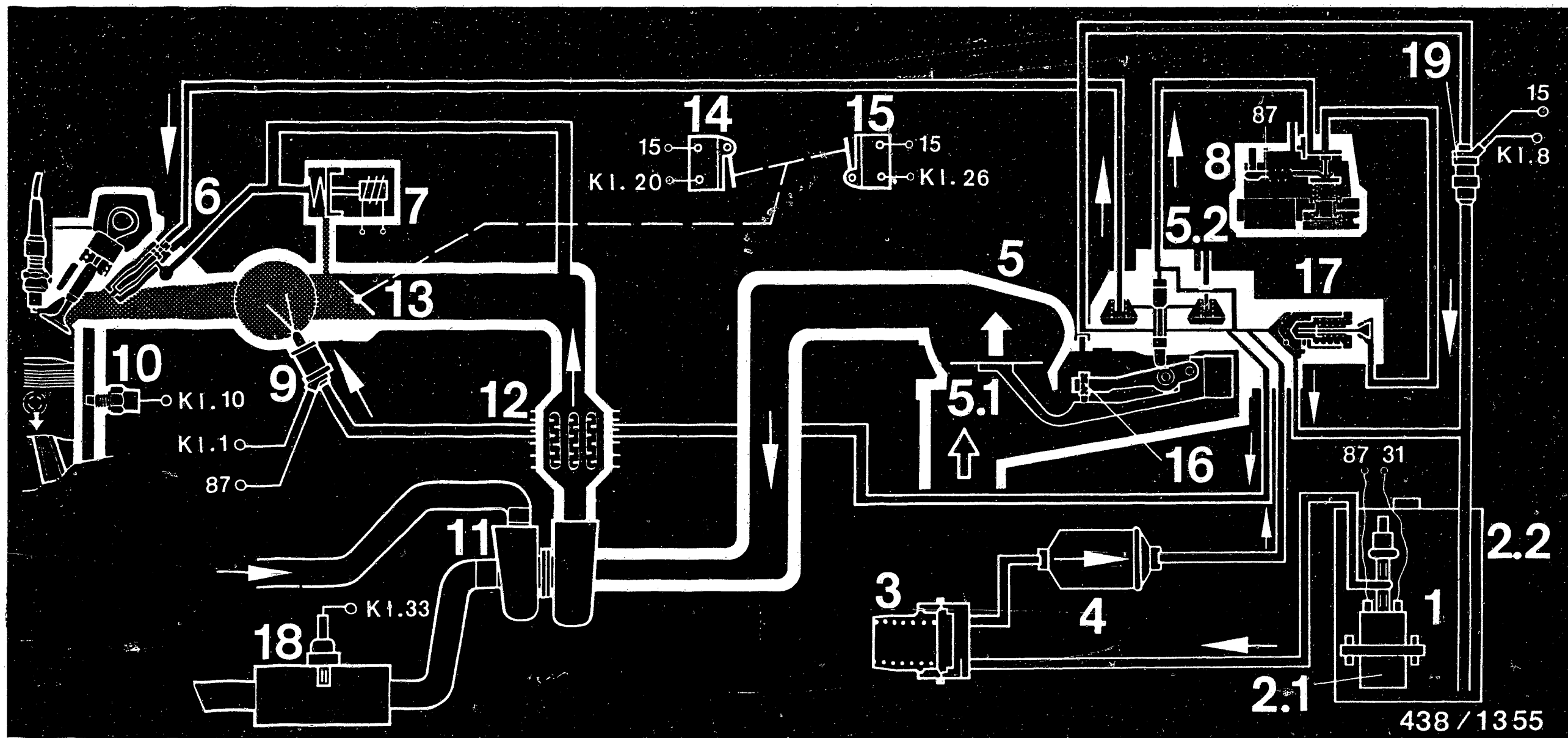
With this, the electric fuel pump and the warm-up regulator are supplied with battery voltage.

C A U T I O N !

Never deflect (raise) the air-flow sensor plate while the electric fuel pump is running. If that is done, fuel is injected via the fuel-injection valves.

A subsequent activation of the starting motor can then cause serious damage to the engine!





4. Fuel line diagram

— Fuel lines

⋯ Intake manifold pressure lines

Kl. = Terminal on the control unit for ignition and fuel-injection

- 1 = Fuel tank
- 2.1 = In-tank electric fuel pump
- 2.2 = Pressure damper
- 3 = Fuel accumulator
- 4 = Fuel filter
- 5 = Mixture-control unit
- 5.1 = Air-flow sensor
- 5.2 = Fuel distributor

- 6 = Fuel-injection valve
- 7 = Idle actuator
- 8 = Warm-up regulator
- 9 = Starting valve
- 10 = "Engine" temperature sensor
- 11 = Exhaust gas turbocharger
- 12 = Charge-air cooler
- 13 = Throttle valve

- 14 = Idle throttle valve switch
- 15 = Full-load throttle valve switch
- 16 = Idle-mixture-adjusting screw
- 17 = Primary pressure regulator with push valve
- 18 = Lambda sensor
- 19 = Timing valve

E12

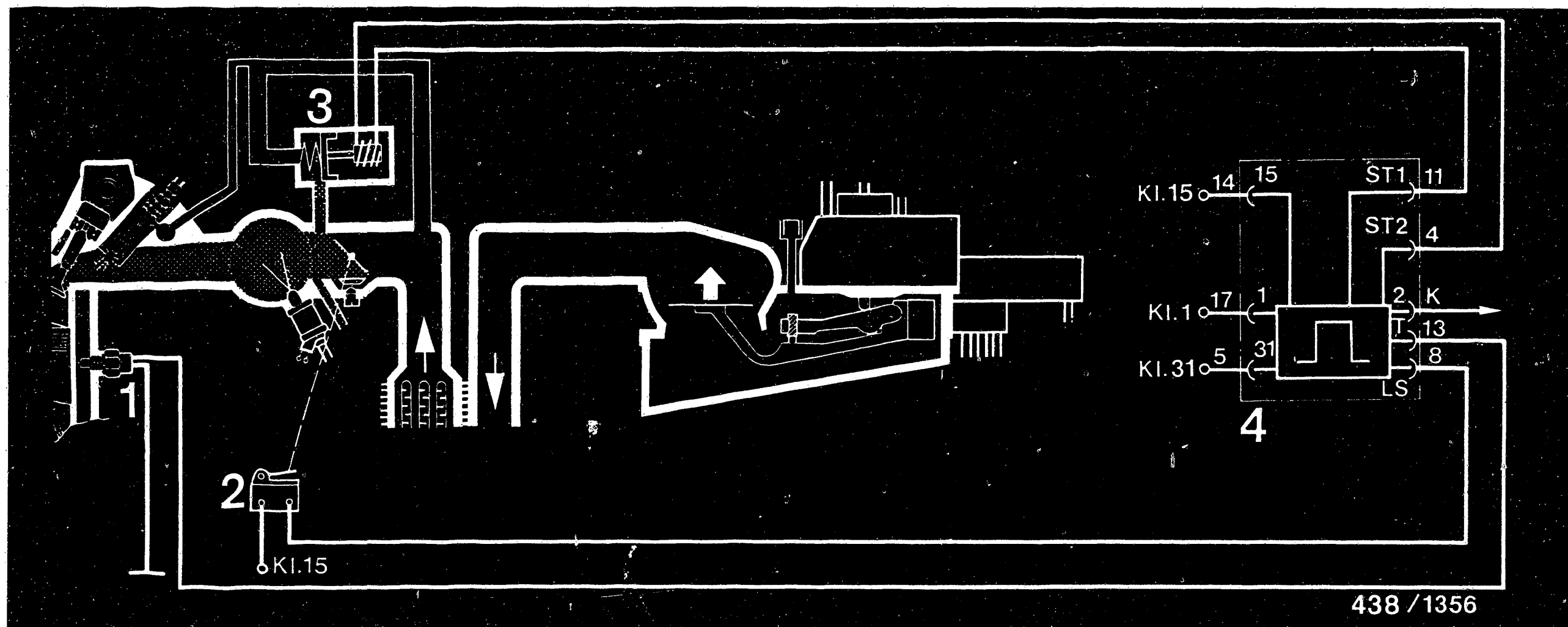
Fuel line diagram
Audi 5000 Turbo



E13

Fuel line diagram
Audi 5000 Turbo





1 = "Engine" temperature sensor
2 = Idle throttle valve switch

3 = Idle actuator
4 = Control unit for idle stabilization

K = to the air-conditioner compressor

5. Idle stabilization (non-Bosch product)

● Operation

The idle speed is stabilized by means of the electronic control unit and the idle actuator. Instead of the auxiliary-air device usually found otherwise, the idle actuator is installed in the air bypass to the throttle valve.

The control unit supplies the tractive electromagnet of the idle actuator with a voltage with a variable pulse at a constant frequency. That causes the screen in the air channel to shift position and changes the amount of air flowing through.

E14

Idle stabilization
Audi 5000 Turbo



E15

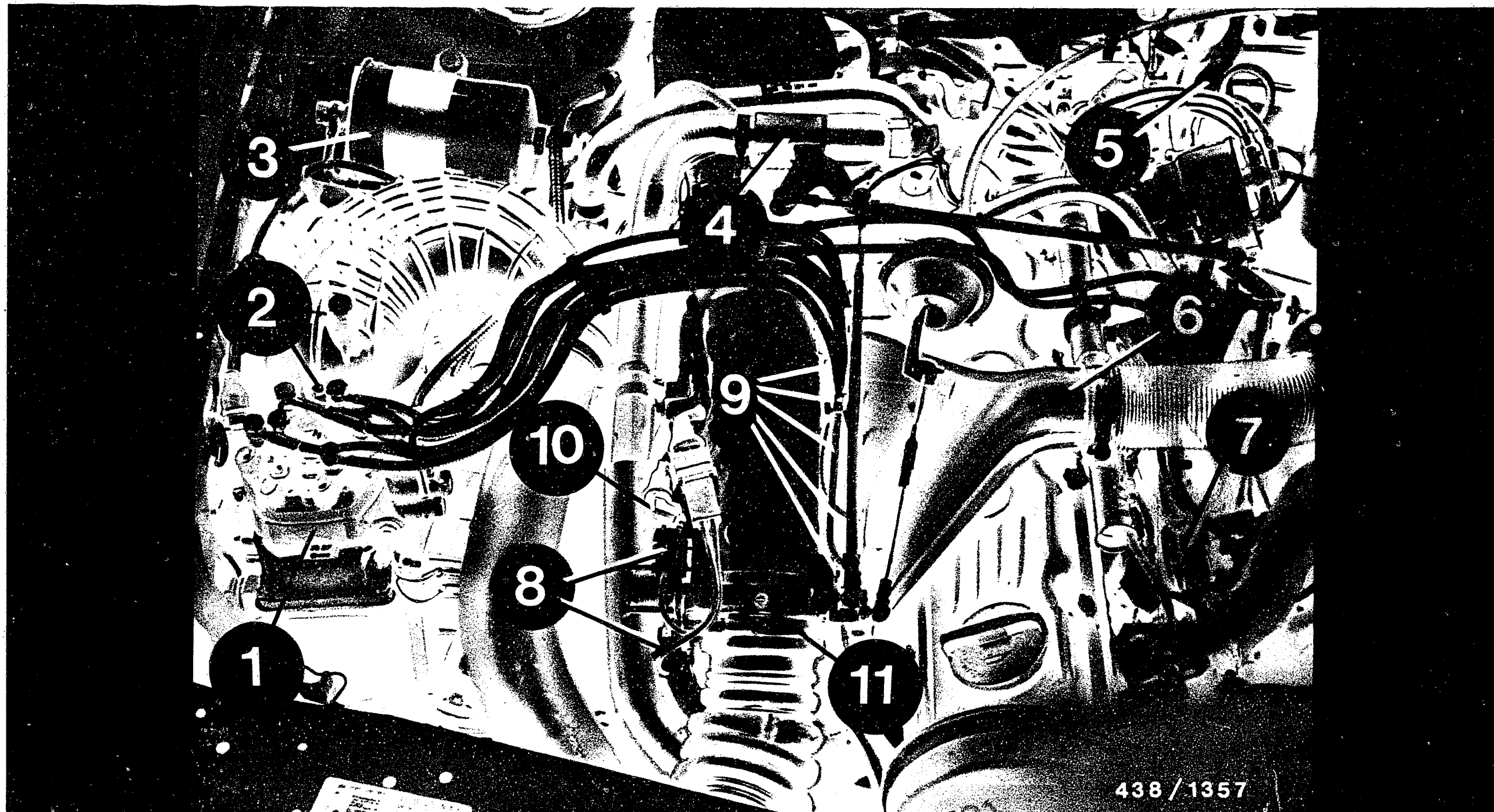
Idle stabilization
Audi 5000 Turbo



6. General safety instructions for working on the K-Jetronic

- Never deflect (raise) the air-flow sensor plate while the electric fuel pump is running. When this is done, fuel is injected via the fuel-injection valves. A subsequent activation of the starting motor can then cause very serious damage to the engine.
- When testing the fuel-injection valves with the valve tester, follow the regulations for the testing medium.
Never run the test using driving gasoline or other highly flammable fluids. Even when using test gasoline, follow the safety regulations in effect locally.
- Test the engine intake system for leaks only with an allowable leak detector (e.g., Gypoflex). Do not use any highly flammable liquids. Follow local safety regulations.





- 1 = Mixture-control unit
- 2 = Idle-mixture-adjusting screw
- 3 = Fuel filter
- 4 = Idle actuator

- 5 = 2-way directional control valve
- 6 = Auxiliary fan for fuel-injection valves
- 7 = Warm-up regulator
- 8 = Idle and full-load throttle valve switches

- 9 = Fuel-injection valves
- 10 = "Air" temperature sensor
- 11 = Idle speed adjusting screw

7. Installation position of the individual components

7.1 Arrangement of the components on the engine

E17

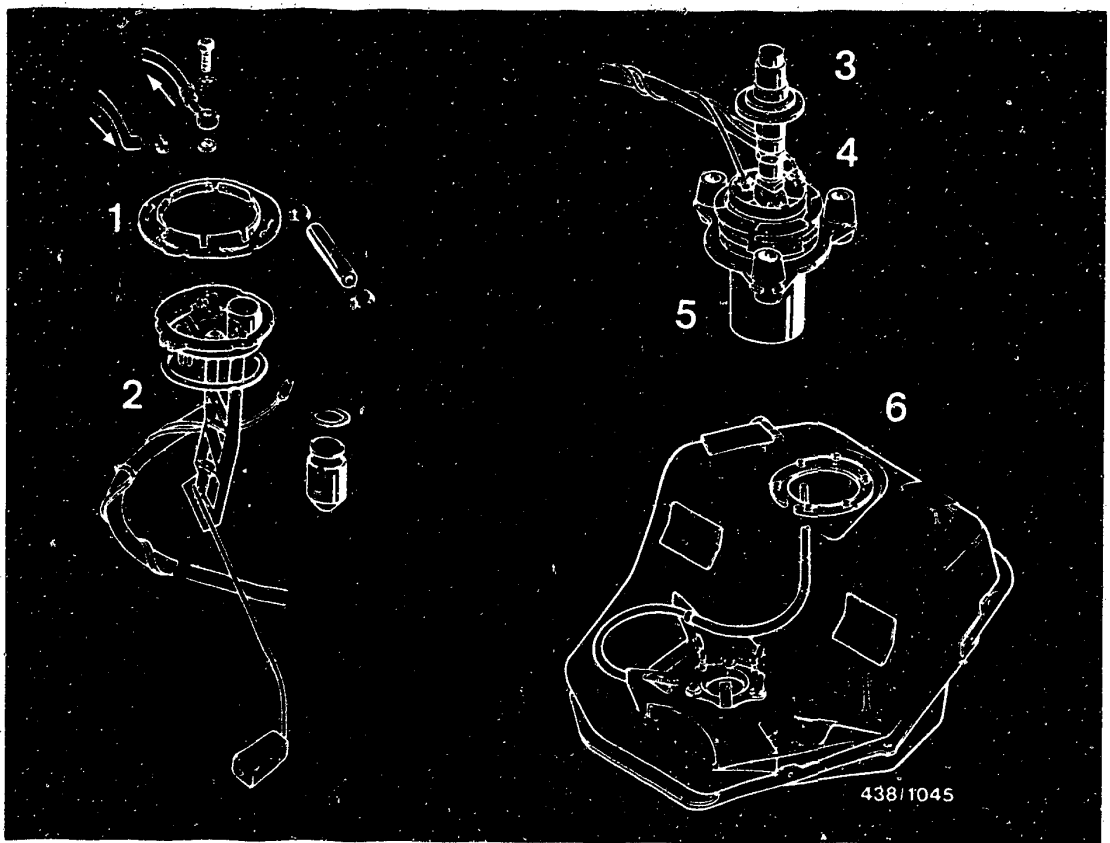
Installation pos. of ind. components
Audi 5000 Turbo



E18

Installation pos. of ind. components
Audi 5000 Turbo





- | | |
|-----------------------------------|------------------------|
| 1 = Lock ring | 4 = Non-return valve |
| 2 = Sensor for fuel gauge display | 5 = Electric fuel pump |
| 3 = Pressure damper | 6 = Fuel tank |

7.2 Components of the fuel supply system

- The in-tank electric fuel pump with the replaceable non-return valve and the screwed-on pressure damper is accessible via the lock ring at the top of the fuel tank.
- The fuel accumulator is mounted on the underside of the vehicle, in front of the fuel tank on the right.



7.3 Other components

- The control unit (non-Bosch product) for the ignition and fuel-injection is on the right in the front passenger's footwell.
- The lambda sensor is screwed into the exhaust pipe, near the engine in the front.
- The timing valve with the molded hose is attached to the mixture-control unit.



Table of contents

1. Special features	F 2
2. Test specifications	F 3
3. Rapid diagnosis chart	F 7
4. Electric wiring diagram	F 20
5. Fuel line diagram	F 22
6. Installation position of components	F 24



1. Special features

These brief SIS instructions apply to the following vehicle types:

Audi 4000 (USA)	7.84 →
VW Golf GTI (USA)	8.84 →

Engine: 4-cyl./1.8 l, 77 kW/105 PS. Longitudinal installation for Audi, transverse installation for VW.

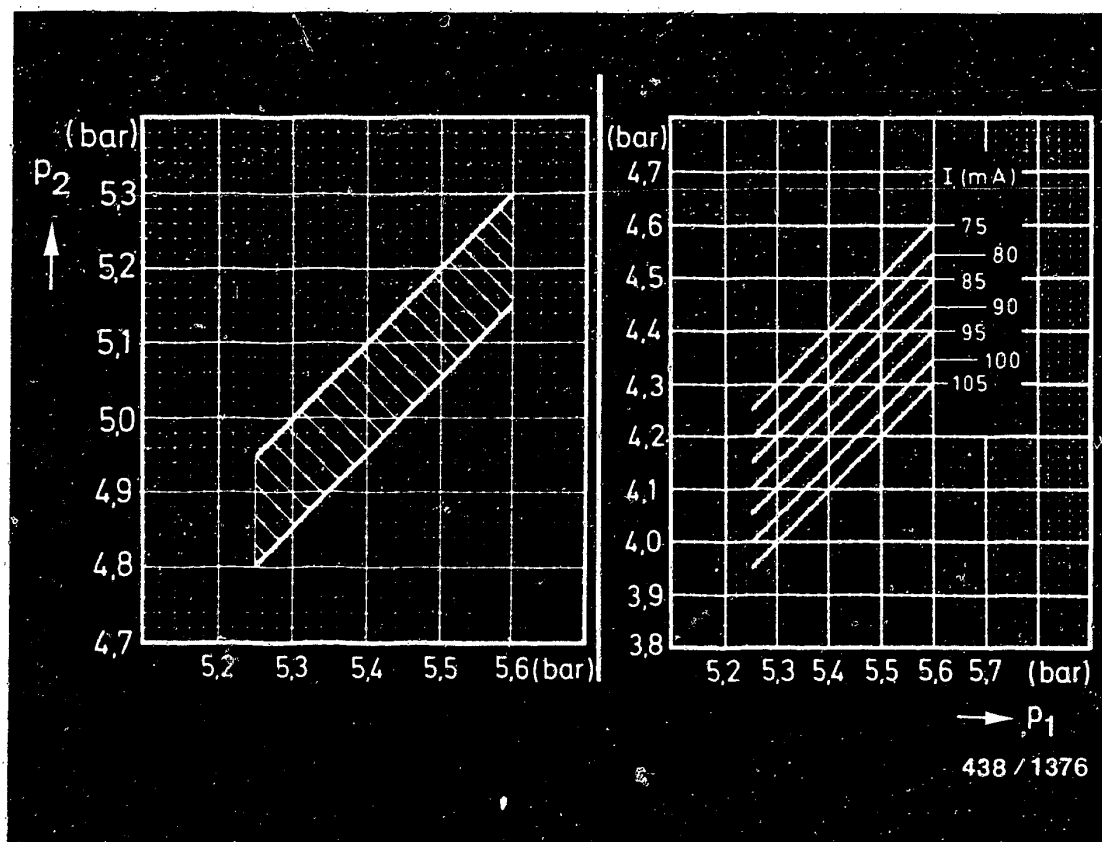
The KE-Jetronic system fitted to these models corresponds to the basic version with the following additional functions or special features:

- Lambda closed-loop control
- Idle speed control (electronic control circuitry incorporated in KE control unit)
- Fuel-injection valves with stationary air guide caps for air shrouding. (Note the special connection system for the tester for delivered quantity comparison.)

Basic microcard for detailed trouble-shooting:
AUDI-507.

Important note: In the case of references to a basic microcard, it should be noted that the test specifications should always be taken from the brief instructions for the specific vehicle concerned.





p_1 = Primary pressure
 p_2 = Lower chamber pressure

2. Test specifications

2.1 Differential pressure:

(Primary pressure/lower chamber pressure)

Obtain the specified value for "warm" lower chamber pressure from the left-hand diagram to correspond to the primary pressure as measured. Actuator current 10 mA.

Obtain the specified value "cold" lower chamber pressure from the right-hand diagram to correspond to the primary pressure as measured and the actuator current as measured.

Note: Tolerance + 0.15 bar

The "cold" condition is simulated by disconnecting the cable plug at the temperature sensor (NTC).

F3

Test specifications

Audi/VW 4-cyl. USA 77 kW/105 PS



2.2 Electric fuel pump

Fuel delivery: min. 1000 cm³/min.

2.3 Primary pressure: 5.25 ... 5.6 bar
(5.35 ... 5.7 kgf/cm²)

2.4 Testing the fuel system as a whole for leaks:

Min. pressure after 10 min: 2.7 bar (2.8 kgf/cm²)

Min. pressure after 20 min: 2.6 bar (2.7 kgf/cm²)

2.5 Fuel-injection valves**

Opening pressure: 3.0 ... 4.1 bar
(3.1 ... 4.2 kgf/cm²)

2.6 Fuel distributor **

Comparative measurement of fuel deliveries:

Load range	Setting point	Max. allowable fuel delivery
Idle	6.0 cm ³ /min.	6.6 cm ³ /min.
Part load	40.0 cm ³ /min.	42.5 cm ³ /min.
Full load	91.0 cm ³ /min.	100.0 cm ³ /min.

Minimum delivery at all outlets with maximum deflection of air-flow sensor plate:

91.0 cm³/min.

Flow rate for KE throttle in fuel distributor:

130 ... 145 cm³/min.

** See next page!



**** Note on the part number for fuel-injection valves:**

The fuel injection valves installed in this engine have the part number 0 437 502 026 (original equipment) or ...027 (sales designation). These valves have an air-guide cap firmly pressed on (for the air shrouding system). For replacements, order valves with the above sales designation ...027 and not in accordance with the designation ..023 as stamped on the valve stem. Connection for the tester for comparison of fuel delivery using adapter sleeves KDJE-P 200/19.

2.7 Temperature sensor

Measurements of resistance:

Engine cold (+15°C...+30°C):	1300 ... 3600 Ω
Engine warm (approx. +80°C).	250 ... 390 Ω

2.8 Thermotime switch

Resistance measurements:

at a temperature

between

	Term. G and ground	Term. W and ground	Term. G and Term. W
below +30°C	25...40 Ω	0 Ω	25...40 Ω
above +40°C	50...80 Ω	100...160 Ω	50...80 Ω

2.9 Air-flow sensor potentiometer

Voltage signal with
air-flow sensor plate
in basic position:

0.01 ... 0.05 V

2.10 Basic setting of idle-mixture-adjusting screw

(fuel-distributor seat -
needle bearing)

18.7 ... 18.9 mm



2.11 Idle adjustment *

Idle speed (regulated
by idle speed control):

850 min⁻¹

On/off ratio to be set
(bypass screw):

28 \pm 1 %

Exhaust gas setting
Pressure actuator trigger current.

Checking value:

4 ... 16 mA

Setting:

9 ... 11 mA

CO level (check value):

0.3 ... 1.2 %

* Instructions for idle adjustment:

The exhaust gas setting is made automatically by the lambda closed-loop control. The object of the test is the triggering current for the pressure actuator in closed-loop control operation (pulsing of reading for current).

The setting should be adjusted to 9...11 mA by turning the idle-mixture-adjusting screw, but only if the reading lies outside the check value 4...16 mA. The CO check value is used to check whether or not there is a leak in the exhaust gas system. CO sampling at the exhaust-sample pipe on the right of the intake manifold. When checking the idle speed, switch off all electrical consuming devices and the air conditioner. The fan for the radiator must not be running. Disconnect the crankcase ventilation hose from the cylinder head cover and leave it open.



3. Rapid diagnostic chart for the universal test adapter
ETT 018.01 with KE-Jetronic test lead 1 684 463 135 and
a suitable multimeter:

The rapid diagnostic chart below makes it possible for the experienced Jetronic expert to check quickly the electrical/electronic peripheral and control unit functions of the KE-Jetronic, including the lambda closed-loop control.

Important instructions for the rapid diagnostic chart
below:

The column "test conditions" shows those test steps at which the control unit must be plugged in or disconnected. In this regard, make absolutely certain that there is no electricity in the system when plugging in or disconnecting, i.e. it is not permissible to jump the electrical safety circuit, and the ignition must be switched off.

The column "test connections" shows the cables incorporated in the relevant test path with reference to the allocations in the control unit cable plug. Any necessary trouble-shooting refers to these cables.



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
1	↓	4	-	Pressure actuator - internal resistance	12 - 10	Disconnect control unit plug.	12 ... 25 Ω
2	↓	5	-	Temperature sensor - internal resistance +15°C...+30°C approx. +80°C	21 - 2	Control unit plug disconnected.	1.3...3.6 k Ω 250...390 Ω
3	↓	11	-	Ground control unit - output stage	20 - 2	Control unit plug disconnected	0...10 Ω
4	↓	9	-	"Idle" throttle valve switch	13 - 2	N.B.: Measurement of voltage; connection for voltmeter: Negative = black socket "V" Positive = blue socket on left " Ω " Control unit plug disconnected. Switch on the ignition. Throttle valve closed: Open throttle valve by hand:	8 ... 15 V 0 V
5	↓	10	-	"Full load" throttle valve switch	5 - 2	N.B.: Measurement of voltage; connection for voltmeter: Negative = black socket "V" Positive = blue socket on left " Ω " Control unit plug disconnected. Switch on the ignition. Throttle valve closed: Throttle valve fully open:	0 V 8 ... 15 V

F8

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



F9

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
6	3	-	-	Signal, air conditioner (air conditioner ready)	16 - 2	Control unit plug disconnected. Switch on the ignition. Switch on the air conditioner.	8 ... 15 V
7	4	-	-	Starting signal Terminal 50 -	24 - 2	Control unit plug disconnected. Activate starting motor:	8 ... 15 V
8	5	-	-	TD signal (ignition)	25 - 2	Control unit plug disconnected. Activate starting motor for a few seconds:	Value for voltage undefined
9	6	-	-	Control unit - power supply	1 - 2	Control unit plug disconnected. Switch on the ignition.	8 ... 15 V
10	7	-	-	Power supply Potentiometer on air-flow sensor	18 - 2	Connect the control unit. Switch on the ignition.	7 ... 8 V
11	8	-	-	Signal poten-tiometer on the air-flow sensor	17 - 2	Control unit connected. Switch on the ignition. Deflect the air-flow sensor plate by hand, causing rise in voltage to max. 8 V.	0 ... 8 V

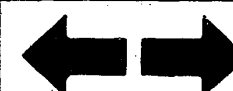
F10

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



F11

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
12	10	-	-	Idle actuator power supply and continuity, coil 1	3 - 2	Disconnect the jumper on the safety circuit. Disconnect the control unit plug. Switch on the ignition:	8 ... 15 V
13	11	-	-	Idle actuator - continuity, coil 2	4 - 2	Control unit plug disconnected. Switch on the ignition:	8 ... 15 V
14	12	-	-	Signal, air conditioner	19 - 2	Connect the control unit. Start the engine. Switch on the air conditioner. Air conditioner does not operate: Air conditioner operates at:	0 V 8 ... 15 V
15	14	24	-	Lambda control Closed-loop control operation	23 - 2	Control unit connected Short-circuit sockets land 2 on test adapter. Start engine and warm it up. Control function: Pulsating voltage reading. Average value:	approx. 3 V
16	-	-	1	Warm-up enrichment	12 - 12	Measurement of current! Connection for tester: Negative = black socket 1 Positive = black socket 2 Control unit connected. Switch on the ignition:	51 ... 71 mA

F12

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



F13

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
17	-	-	2	Actuator current corresponding to engine at normal operating temperature	12 - 12	Control unit connected. Switch on the ignition:	9 ... 11 mA
18	-	-	1/4	Post-start enrichment	12 - 12	Control unit connected. Switch on the ignition. Hold down button 1: Press button 4. Current increases to: After a brief time, cuts back to: Cutback time approx. 90 seconds.	51... 71 mA 130...150 mA 51... 71 mA
19	-	-	1/6	Acceleration enrichment	12 - 12	Control unit connected. Switch on the ignition. Hold down both buttons. Value for current: Deflect the air-flow sensor plate sharply. Current rises to: Cuts back in approx. 1 second to:	51... 71 mA 130...150 mA 51... 71 mA

F14

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



F15

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
20	-	-	2	Overrun cutoff	12 - 12	Control unit connected. Reverse terminals on ammeter (interchange positive and negative). Start the engine and hold at 1800...2000 min ⁻¹ . While pressing button 2, activate the idle throttle valve switch by hand. The engine hunts. Reading for current during speed-drop phases: There must not be any overrun cutoff when the cruise control is switched on.	40...50 mA
21	-	-	-	Full-load enrichment	12 - 12	Control unit connected. Connect up ammeter normally (1-, 2+). Start the engine and hold at 4000 min ⁻¹ . Activate the full-load throttle valve switch:	12...16 mA
22	-	24	-	Lambda closed-loop control	12 - 12 8 - 12	Control unit connected. Start the engine, warm it up and operate it at idle speed. Closed-loop control operation of the lambda control can be identified from the pulsing of the reading for current. Average value: If average value is not within tolerance, make adjustment (idle-mixture-adjusting screw) to:	4 ... 16 mA 9 ... 11 mA
23	-	22	-	Lambda closed-loop control - Rich stop	12 - 12 8 - 2	Control unit connected. Switch on the ignition: Current rises to:	max. 22 mA

F16

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



F17

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
24		23	-	Lambda closed-loop control - lean stop	12 - 12 8 - 2	Control unit connected. Switch on the ignition: Current drops to:	less than 2 mA
25	10	-	-	Idle speed control		Testing with lambda closed-loop control tester KDJE-P 600. Press buton "IR". Jump black sockets 1 and 2 on the test adapter. Bring engine to normal operating temperature and run it at idle. Idle speed (set by control): On/off ratio: If need be, adjust the on/off ratio (bypass screw on the throttle valve assembly).	800-900 min ⁻¹ 28 \pm 1 %
26	10	-	see text	Idle speed control - correction functions		Press button 6 (corresponds to opening of the idle throttle valve switch). On/off ratio:	34 - 38 %
						Switch on the air conditioner (compressor). Speed:	850-950 min ⁻¹
						Engine speed boost, engine cold. (Testing only with engine cold.) Engine temperature less than +25°C +25°C - +40°C	950-1050min ⁻¹ 850- 950min ⁻¹

F18

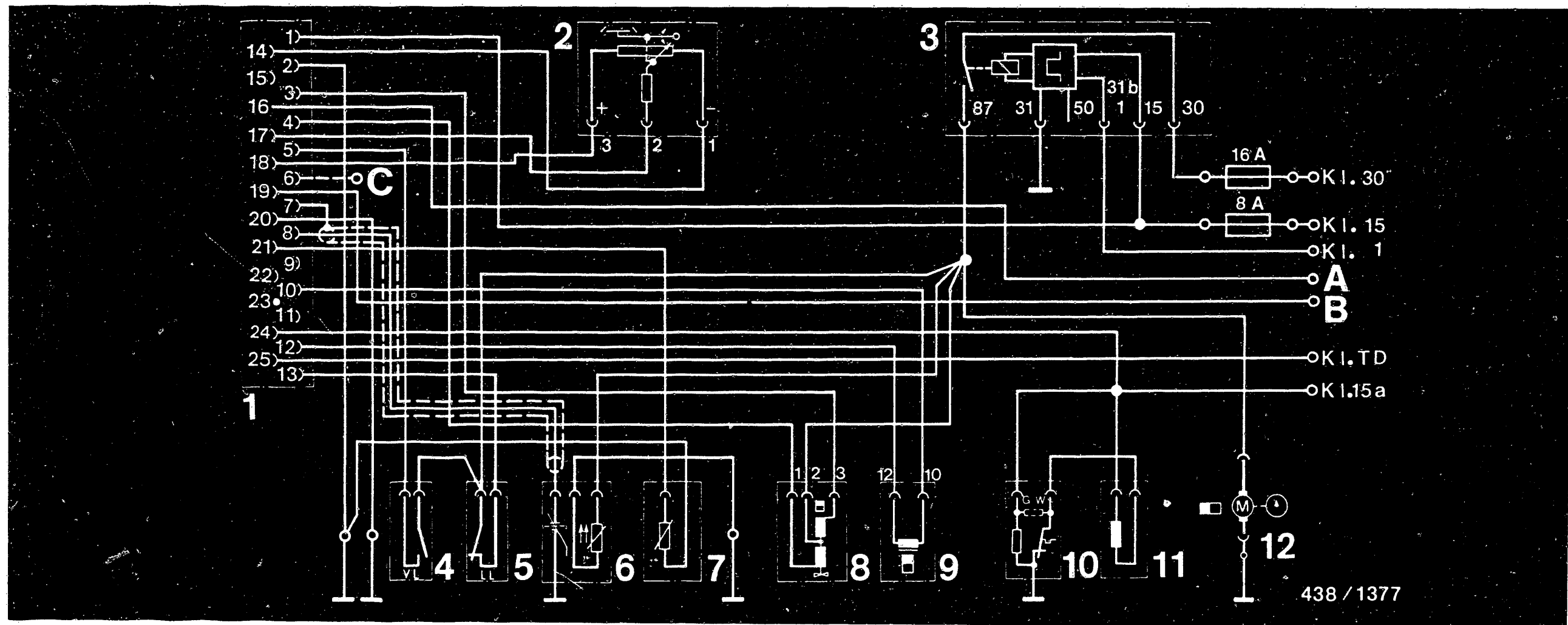
Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS



F19

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA 77 kW/105 PS





4. Electrical wiring diagram for the KE-Jetronic with safety circuit

- 1 = Control unit
- 2 = Air-flow sensor potentiometer
- 3 = Electronic speed relay
- 4 = Full-load throttle valve switch
- 5 = Idle throttle valve switch
- 6 = Lambda sensor with sensor heater
- 7 = Temperature sensor (NTC)
- 8 = Idle actuator

- 9 = Pressure actuator
- 10 = Thermotime switch
- 11 = Cold-start valve
- 12 = Electric fuel pump

- A = Cable for air-conditioner (control panel)
- B = Cable for air-conditioner compressor
- C = Connection for cruise control

Jumping the electrical safety circuit for pressure measurements:

Disconnect the speed relay (3) from the relay base, and jump the terminals 30 and 87 with an auxiliary lead.

Important: It is necessary for the electric fuel pump to operate only for pressure measurements. For electrical tests, only switch on the ignition.

F20

Electrical wiring diagram

Audi/VW 4-cyl. USA 77 kW/105 PS



F21

Electrical wiring diagram

Audi/VW 4-cyl. USA 77 kW/105 PS



6. Installation position of components

6.1 Installation position for Audi (longitudinal installation):

Mixture-control unit, primary pressure regulator: On inner right-hand fender.
Cold-start valve: On intake manifold next to throttle-valve assembly.
Throttle valve switch: On throttle-valve assembly, idle at bottom, full load at top.
Fuel-injection valves: On intake tube flanges.
Idle actuator: Above cylinder head, in vicinity of throttle-valve assembly
Thermotime switch, temperature sensor: In coolant fitting, on left of engine.
Control unit: Mounted on right of glove compartment, and accessible only after removal of glove compartment.
Electric fuel pump, fuel accumulator and fuel filter: The fuel supply components are mounted on the underside of the vehicle in the area in front of the rear axle.

6.2 Installation position for VW (transverse installation)

Mixture-control unit, primary-pressure regulator: On left of engine compartment.
Cold-start valve: In intake manifold, opposite throttle-valve assembly
Throttle valve switch: On throttle-valve assembly, idle at bottom, full load at top.
Fuel-injection valves: On intake tube flanges.
Idle-actuator: In bypass line on throttle-valve assembly.
Thermoswitch, temperature sensor: In coolant fitting at front of engine.
Fuel filter: Next to mixture-control unit.
Electric fuel pump with pressure-side damper: Directly flange-mounted on fuel tank.
Fuel accumulator: Above the rear axle.



Table of contents

<u>Section</u>	<u>Coordinates</u>
1. Special features	G 2
2. Test specifications	G 3
3. Rapid diagnostic chart	G 10
4. Electrical wiring diagram	G 17
5. Fuel line diagram and air paths	G 20
6. General safety instructions	G 22
7. Installation position of components	G 23



1. Special features

These brief SIS instructions apply to the following vehicles:

Audi 4000 (USA)	11.83 →
Audi 80 (Japan)	9.83 →
VW Jetta/Rabbit (USA)	7.84 →
VW Golf (Japan)	1.84 →

Engine: 4-cyl./1.8 l, 66 kW/90 PS. Longitudinal installation for Audi, transverse installation for VW.

The KE-Jetronic system in these models corresponds to the basic version, but with a reduced number of functions:

Without full-load enrichment, without altitude sensor, without overrun cutoff. The throttle valve switch idle/full load is omitted.

Special equipment:

- Lambda closed-loop control.
- Fuel-injection valves with stationary air guide caps for air shrouding. (Note the special connection system for the tester for delivered quantity comparison.)
- Solenoid valve (2 valves with air conditioning) in air system for idle increase.

Basic microcard for detailed trouble-shooting in mechanical/hydraulic section: SIS-AUD 507. This also applies to the detailed test chart for the electronic functions; the test steps for unused functions should be ignored.

Important note:

In the case of references to a basic microcard, it should be noted that the test specifications should always be taken from the brief instructions for the specific vehicle concerned.



2. Test specifications

Test step

Test specifications*

2.1 Electric fuel pump:

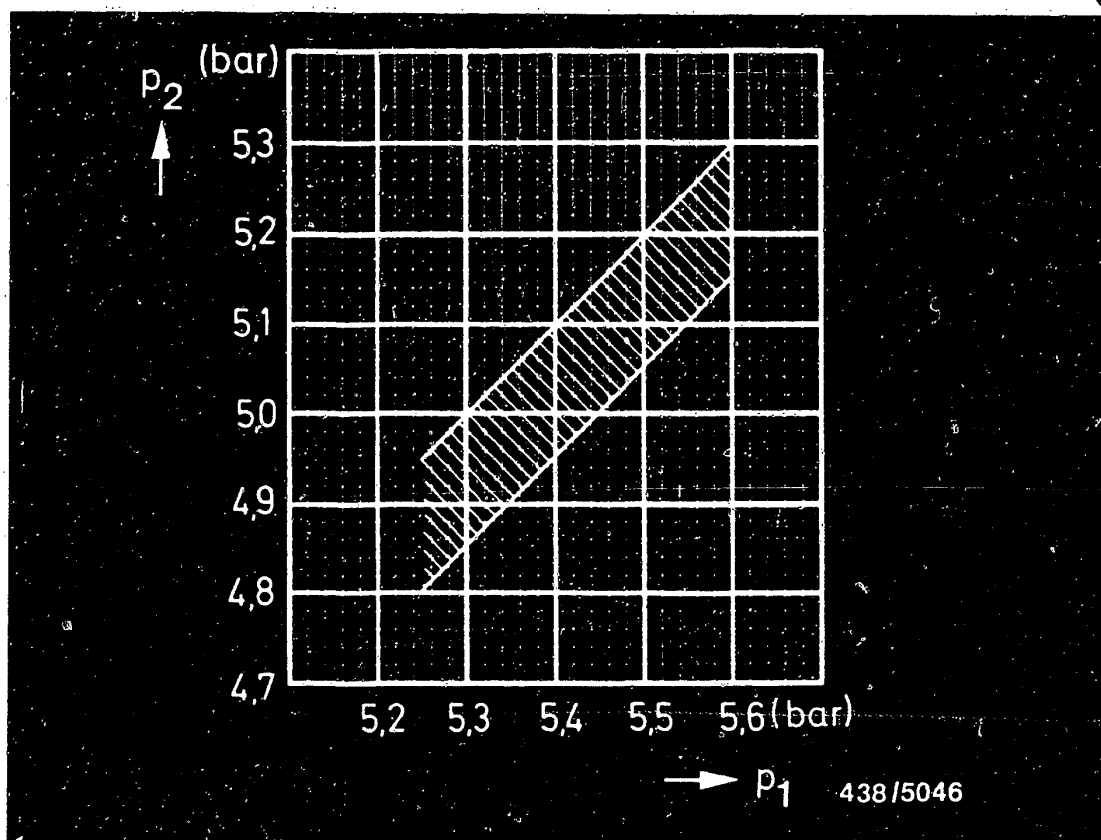
Fuel delivery: min. 800 cm³/min.

2.2 Fuel pressure:

Primary pressure: 5.25 ... 5.6 bar
(5.35 ... 5.7 kgf/cm²)

* Pressure are indicated in the table of test specifications in bar (gauge pressure) and/or in kgf/cm² (gauge pressure).





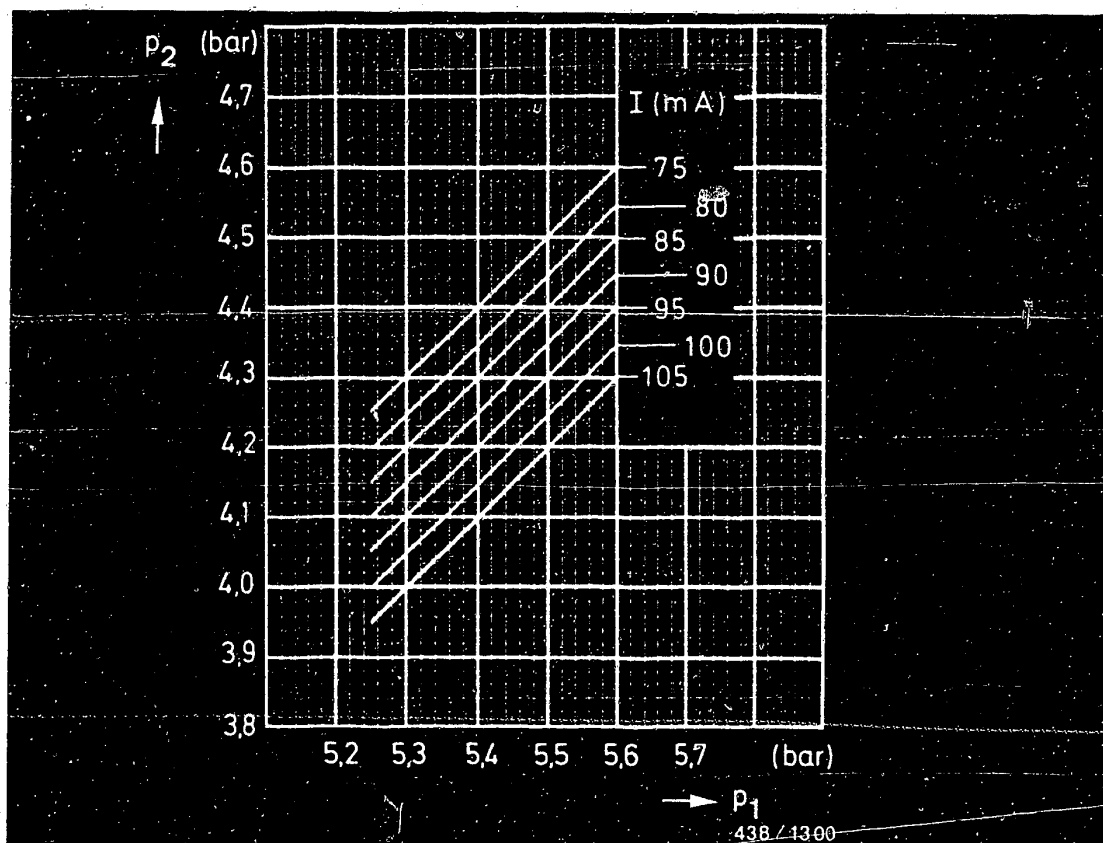
p_1 = Primary pressure

p_2 = Lower-chamber pressure, controller current = 0 mA

Differential pressure:

(Primary pressure/lower-chamber pressure)

Take the "warm" lower-chamber set-value pressure from the graph in accordance with the measured primary pressure.



p_1 = Primary pressure

p_2 = Lower-chamber pressure "cold". Tolerance ± 0.15 bar

I = Controller current

Take the "cold" lower-chamber set-value pressure from the graph in accordance with the measured primary pressure and the measured controller current. The "cold" state is simulated by removing the plug from the temperature sensor (NTC).



Test stepTest specifications*2.3 Testing the fuel system as a whole for leaks:

Min. pressure after 10 min: 2.7 bar (2.8 kgf/cm²)
after 20 min: 2.6 bar (2.7 kgf/cm²)

2.4 Fuel injection valves:**

Opening pressure 3.0 ... 4.1 bar
(3.1 ... 4.2 kgf/cm²)

2.5 Checking the fuel distributor:**
(Checking with pressure actuator attached.
Actuator current 10 mA)

Comparative measurement of fuel deliveries from outlets:	Setting point	Max. allowable fuel delivery
--	---------------	------------------------------

Idle:	6.0 cm ³ /min	6.6 cm ³ /min
Part load:	40.0 cm ³ /min	42.5 cm ³ /min
Full load:	91.0 cm ³ /min	100.0 cm ³ /min

The full-load delivery is a minimum value which must be achieved at each outlet with maximum deflection of the air-flow sensor plate.

Flow rate for
KE throttle in fuel distributor: 130...145 cm³/min

* Pressures are indicated in the test specifications in bar (gauge pressure) and/or kgf/cm² (gauge pressure).



**** Note on the part number for the fuel-injection valve:**

The fuel-injection valves installed in this engine have the part number 0 437 502 026 (original equipment) or .. 027 (sales designation). These valves have an air-guide cap firmly pressed on (for the air shrouding system). For replacements, order valves with the above sales designation .. 027 and not in accordance with the designation .. 023 as stamped on the valve stem. Connection for the tester for comparison of fuel delivery using adapter sleeves KDJE-P 200/19.

Test step

Test specifications

2.6 Temperature sensor

Measurements of resistance:

Engine cold, ambient temperature (+15°C...+30°C): 1300 ... 3600 Ω

Engine at normal operating temperature (approx. +80°C): 250 ... 390 Ω

2.7 Auxiliary-air device

Resistance of heater winding: 30 ... 65 Ω



2.8 Thermotime switch

Resistance measurements:

Measurements of resistance between

at a temperature Term. "G" and Term. "W" and Term. "G"

	ground (housing)	ground (housing)	and Term. "W"
below +30°C	25...40 Ω	0 Ω	25...40 Ω
above +40°C	50...80 Ω	100...160 Ω	50...80 Ω

Test step

Test specifications

2.9 Air-flow sensor potentiometer:

Voltage signal with
air-flow sensor plate
in basic position:

0.01 ... 0.05 V

2.10 Basic setting of idle-mixture-adjusting screw (fuel distributor seat - needle bearing):

18.8 \pm 0.1 mm

2.11 Idle adjustment:*

Idle speed:

800...1000 min⁻¹

Exhaust gas setting:
Testing of the pressure
actuator trigger current:

Checking value

= 4 ... 16 mA

Setting

= 9 ... 11 mA

CO-level (check value)

= 0.3 ... 1.2 vol. %



* Instructions for idle adjustment

The exhaust gas setting is made automatically by the lambda closed-loop control, but the triggering current for the pressure actuator should be checked in closed-loop control operation and if need be corrected by adjustment of the idle-mixture-adjusting screw in the mixture-control unit.

Closed-loop control operation can be identified by the pulsing of the reading for current. If the control operation is within the check value (4...16 mA), no readjustment is required.

If the control range is not within the limit values, make an adjustment. In doing so, set the average value for the pulse reading to the setting value (9...11 mA).

The CO check value is used to check whether or not there is a leak in the exhaust gas system. CO sampling at the special exhaust-sample pipe that is connected to the exhaust pipe in front of the catalytic converter and is directed to the engine compartment. After measurement, reseal the pipe fitting tightly once again.

The radiator fan must not be running during the adjustment. All electrical consuming devices and the air conditioner must be switched off. Disconnect the crankcase ventilation hose from the cylinder head cover and position it so that fresh air is taken in.

Ensure that the two valves for idle increase are not leaking; if need be, disconnect the hose.



3. Rapid diagnostic chart for the universal test adapter
ETT 018.01 with KE-Jetronic test lead 1 684 463 135 and
a suitable multimeter:

The rapid diagnostic chart below makes it possible for the experienced Jetronic expert to check quickly the electrical/electronic peripheral and control unit functions of the KE-Jetronic, including the lambda closed-loop control.



Important instructions for the rapid diagnostic chart
below:

The column "test conditions" shows those test steps at which the control unit must be plugged in or disconnected. In this regard, make absolutely certain that there is no electricity in the system when plugging in or disconnecting, i.e. it is not permissible to jump the electrical safety circuit, and the ignition must be switched off.

The column "test connections" shows the cables incorporated in the relevant test path with reference to the allocations in the control unit cable plug. Any necessary trouble-shooting refers to these cables.



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
1		4	-	Pressure actuator - internal resistance	12 - 10	Disconnect control unit plug.	21 ... 25 Ω
2		5	-	Temperature sensor - internal resistance +15°C...+30°C approx. +80°C	21 - 2	Control unit plug disconnected.	1.3 ... 3.6 k Ω 0.25 ... 0.39k Ω
3	4	-	-	Starting signal Term. 15a - starting motor	24 - 2	Control unit plug disconnected. Activate starting motor:	8 ... 15 V
4	6	-	-	Control unit - power supply	1 - 1	Control unit plug disconnected. Switch on ignition:	8 ... 15 V
5	7	-	-	Power supply Potentiometer on air-flow sensor	18 - 2	Connect the control unit. Switch on the ignition:	7 ... 8 V
6	8	-	-	Signal - potentiometer on air-flow sensor	17 - 2	Connect the control unit. Switch on the ignition. Deflect the air-flow sensor plate by hand, causing rise in voltage to max. 8 V.	0 ... 8 V

G11

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA/Japan 66 kW/90 HP



G12

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA/Japan 66 kW/90 HP



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
7	14	24	-	Lambda control Closed-loop control operation	23 - 2	Control unit connected. Jump sockets 1 and 2 on the test adapter. Start the engine and warm it up. Closed-loop control operation: Pulsing voltage reading. Average value:	approx. 3 V
8	-	-	1	Warm-up enrichment -20°C	12 - 12	Measurement of current! Connection for tester: Negative - black socket 1 Positive - black socket 2 Connect control unit. Switch on the ignition:	52 ... 72 mA
9	-	-	2	Actuator current corresponding to engine at normal operating temperature	12 - 12	Control unit connected. Switch on the ignition:	9 ... 11 mA
10	-	-	1/4	Post-start enrichment	12 - 12	Control unit connected. Switch on the ignition. Hold down button 1: Press button 4. Current increases to: When button 4 is released, cuts after a brief time back to: Cutback time:	52 ... 72 mA 130 ... 150 mA 52 ... 72 mA approx. 90 s

G 13

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA/Japan 66 kW/90 PS



G 14

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA/Japan 66 kW/90 PS



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
11	-	-	1	Acceleration enrichment	12 - 12	Control unit connected. Switch on the ignition. Hold down button 1. Value for current: Deflect the air-flow sensor plate rapidly. Current rises to: Cuts back in approx. 1 second to:	52 ... 72 mA 130 ... 150 mA 52 ... 72 mA
12	-	24	-	Lambda closed-loop control	12 - 12 8 - 2	Control unit connected. Start the engine, warm it up and operate it at idle speed. Closed-loop control operation of the lambda control can be identified from the pulsing of the reading for current. Average value: If average value is not within tolerance, adjust to:	4 ... 16 mA 9 ... 11 mA
13	-	22	-	Lambda closed-loop control - full load correction	12 - 12 8 - 2	Control unit connected. Switch on the ignition. Current rises to:	max. 20 mA
14	-	23	-	Lambda closed-loop control - lean stop	12 - 12 8 - 2	Control unit connected. Switch on the ignition. Current drops to:	less than 2 mA

G15

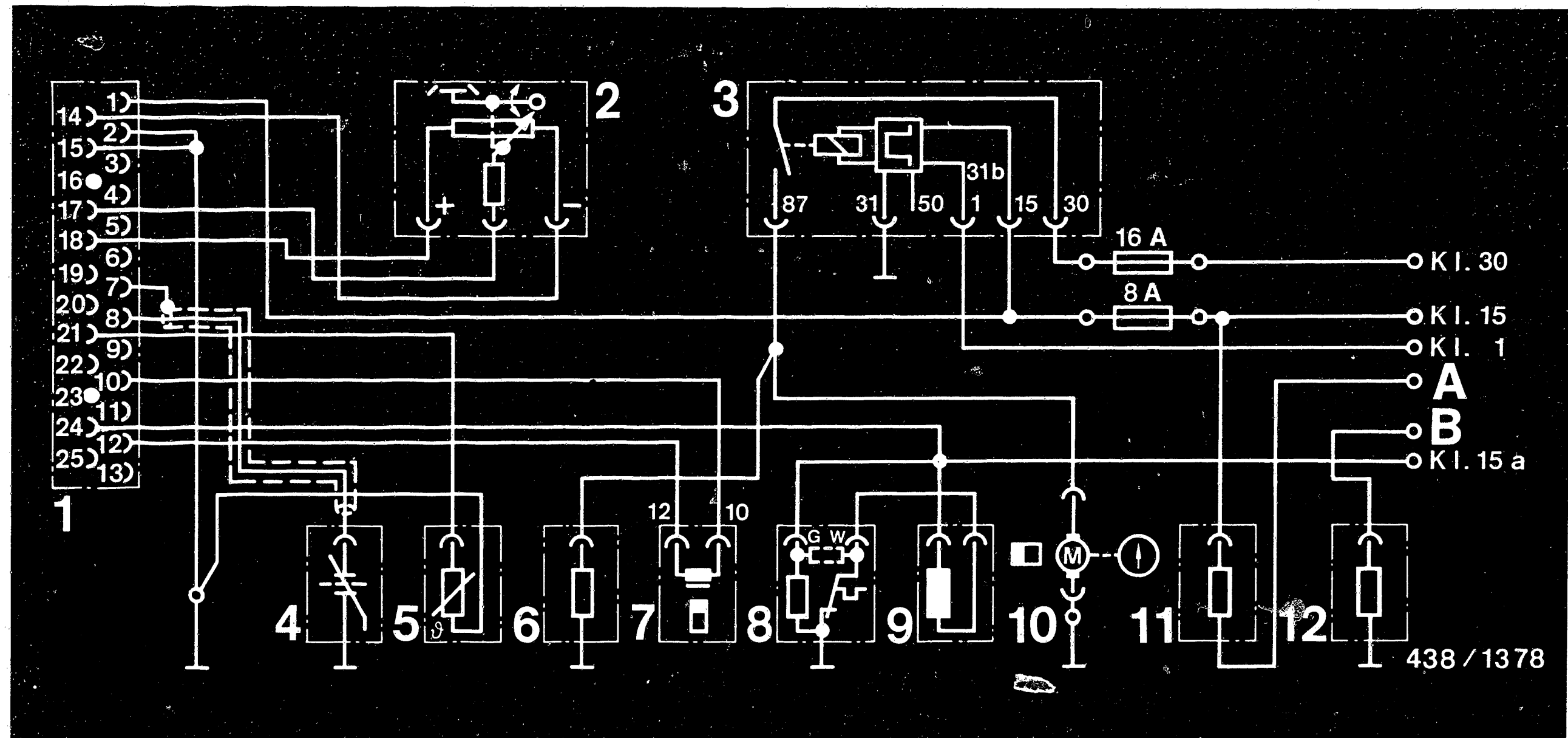
Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA/Japan 66 kW/90 HP



G16

Rapid diag. chart for univ. test adapter
Audi/VW 4-cyl. USA/Japan 66 kW/90 HP





4. Electrical wiring diagram for the KE-Jetronic with safety circuit and idle increase

- 1 = Control unit
- 2 = Air-flow sensor potentiometer
- 3 = Electronic speed relay
- 4 = Lambda sensor
- 5 = Temperature sensor (NTC)
- 6 = Auxiliary-air device
- 7 = Electrohydraulic pressure actuator
- 8 = Thermotime switch

- 9 = Cold-start valve
- 10 = Electric fuel pump
- 11 = Idle increase valve 1
- 12 = Idle increase valve 2 (only with air conditioner)
- A = Ground signal from control relay (in relay base) for speed increase. Switch-on point below 700 min⁻¹, switch-off point above 1050 min⁻¹.
- B = Positive signal from air conditioner

G17

Electrical wiring diagram

Audi/VW 4-cyl. USA/Japan 66 kW/90 PS



G18

Electrical wiring diagram

Audi/VW 4-cyl. USA/Japan 66 kW/90 PS



4.1 Jumping the electrical safety circuit

For all pressure and fuel-delivery tests, the electrical safety circuit must be jumped. The electric fuel pump and auxiliary-air device are supplied with voltage via the electronic speed relay of the safety circuit.

Installation position of speed relay for Audi:

In the central electrical unit, in the engine compartment in front of the windshield, on the left looking in the direction of forward vehicle travel, white relay.

Installation position for VW:

In the central electrical unit, on the left looking in the direction of forward vehicle travel, below the instrument panel.

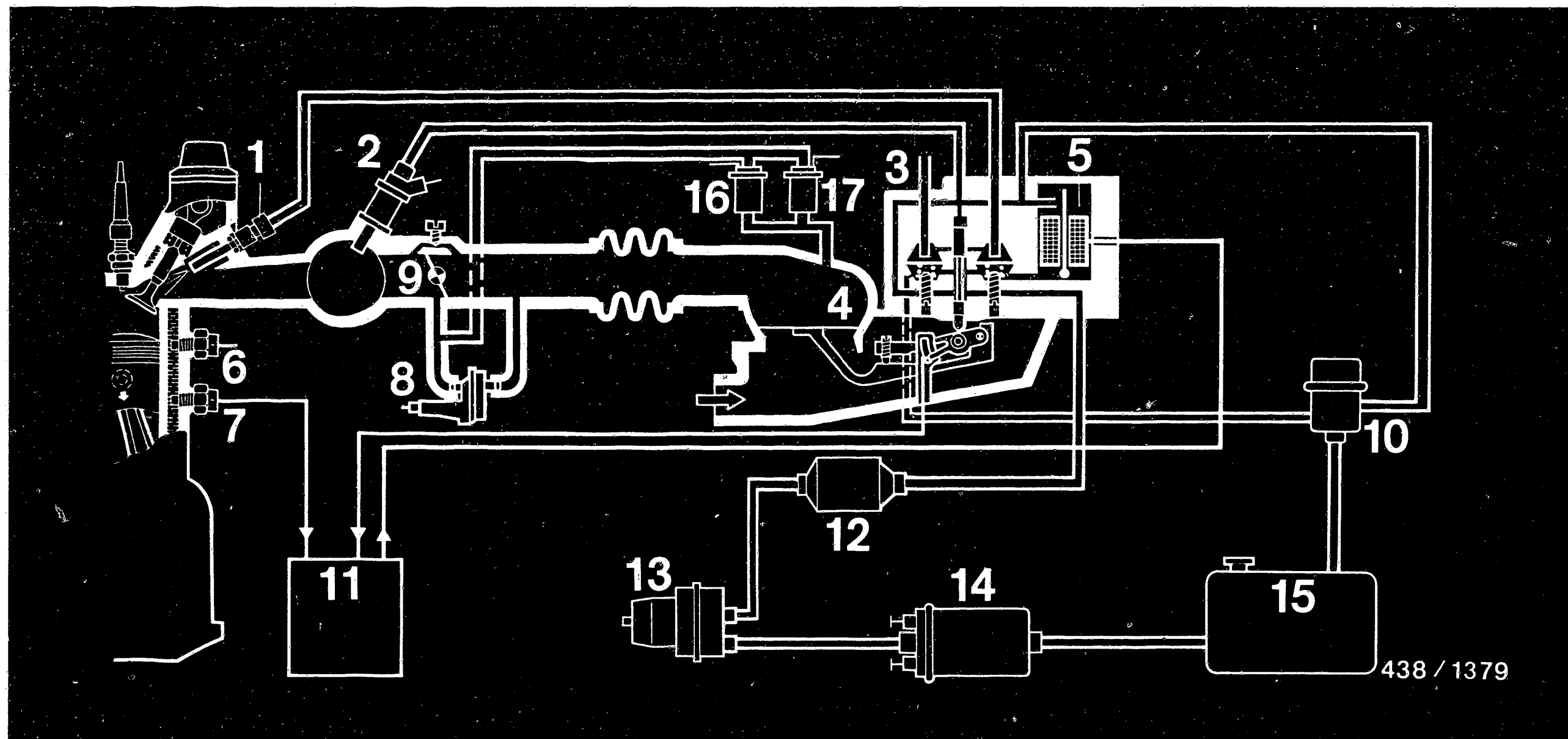
To jump the circuit, disconnect the relay and jump the connecting sockets 30 and 87 in the relay base with an auxiliary lead. Equip the auxiliary lead with a fuse element and a 16 A fuse. Width of the blade terminal: 9.5 mm.

Important instruction:

Never deflect (raise) the air-flow sensor plate while the electric fuel pump is running, otherwise fuel will be injected via the fuel-injection valves. If the engine is then started, serious damage to the engine may result.

For all electrical tests, only switch on the ignition!





438 / 1379

5. Fuel line diagram and air paths for the KE-Jetronic

- 1 = Fuel-injection valve
- 2 = Cold-start valve
- 3 = Fuel distributor
- 4 = Air-flow sensor
- 5 = Electrohydraulic pressure actuator
- 6 = Thermotime switch
- 7 = Temperature sensor (NTC)

- 8 = Auxiliary-air device
- 9 = Throttle valve
- 10 = Pressure regulator (primary pressure)
- 11 = Control unit
- 12 = Fuel filter
- 13 = Fuel accumulator
- 14 = Electric fuel pump

- 15 = Fuel tank
- 16 = Idle increase valve 1
- 17 = Idle increase valve 2
(only with air conditioner)

G20

Diagram of fuel lines, air paths

Audi/VW 4-cyl. USA/Japan 66 kW/90 PS



G21

Diagram of fuel lines, air paths

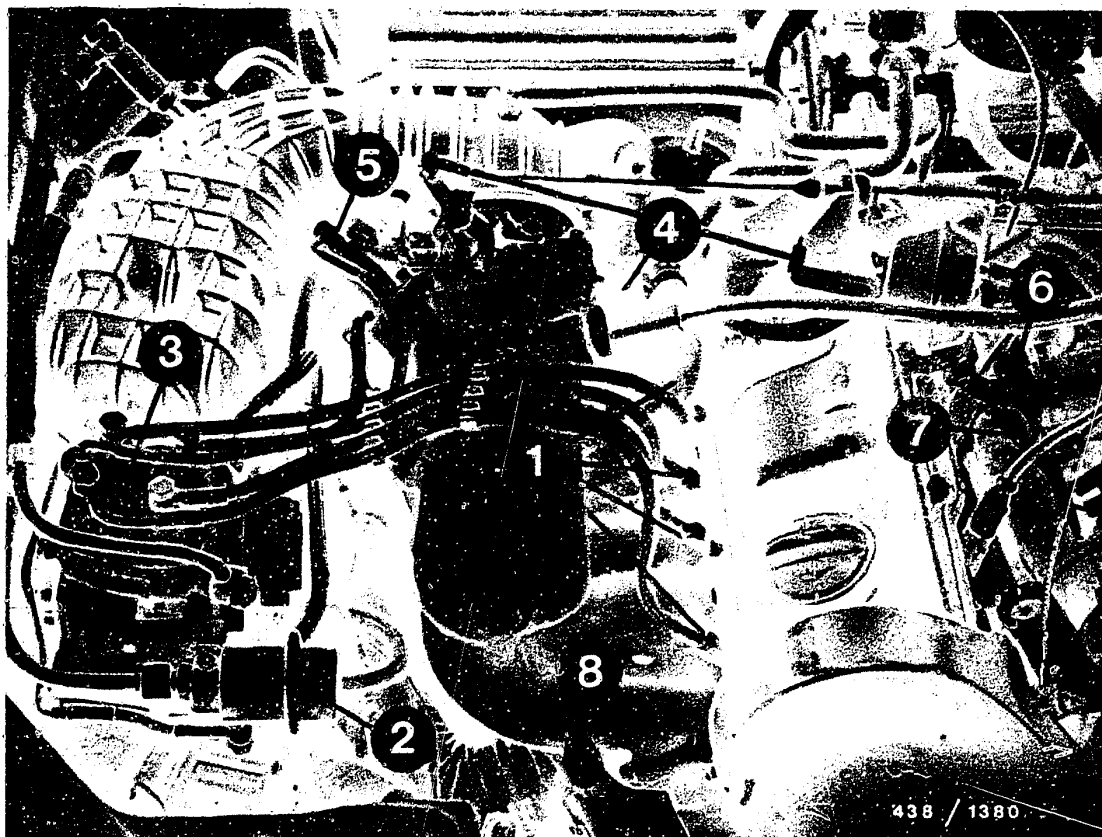
Audi/VW 4-cyl. USA/Japan 66 kW/90 PS



6. General Safety Instructions for Work on Vehicles with KE-Jetronic

- While testing with the electric fuel pump operating, never deflect (raise) the air-flow sensor plate since fuel will be injected through the injection valves. When the engine is subsequently started, this may lead to serious engine damage.
- Observe the instructions on test media when testing the injection valves with the valve tester. Never use normal gasoline or other easily inflammable liquids. Even when using test gasoline, observe the local safety regulations.
- Leak test on engine intake system only with allowable leak-detector spray. (E.g. Gypoflex). Do not use any easily inflammable liquids. Observe local safety regulations.
- Never start the engine without securely connected battery.
- Never disconnect the battery from the vehicle electrical system with the engine running.
- When fast-charging the battery, disconnect it from the vehicle electrical system.
- Remove the KE-Jetronic control unit at temperatures above +80°C (paint-drying installation).
- Before performing electrical welding work (e.g. spot welding), remove the KE-Jetronic control unit.
- Make sure that all wiring-harness connectors are securely connected.
- Never disconnect or connect the wiring-harness plug of the control unit with the ignition on.





- 1 = Fuel-injection valves
- 2 = Primary-pressure regulator
- 3 = Mixture-control unit
- 4 = Auxiliary-air device (not visible, below throttle-valve assembly)
- 5 = Cold-start valve
- 6 = Thermotime switch
- 7 = Temperature sensor (not visible, on underside of valve assembly)
- 8 = Connection tube for exhaust-gas measurements

7. Installation position of components

7.1 Installation position for Audi (longitudinal installation)



Control unit: Mounted on right of glove compartment, and accessible only after removal of glove compartment.

Electric fuel pump, fuel accumulator and fuel filter: The fuel supply components are mounted on the underside of the vehicle in the area in front of the rear axle.

7.2 Installation position for VW (transverse installation):

Component on engine:	As for Audi.
Mixture-control unit:	On the left in the engine compartment.
Control unit:	In the radiator tank, on the left looking in the direction of forward vehicle travel.
Fuel filter:	In the engine compartment, on the left, next to the mixture-control unit.
Electric fuel pump with pressure-side pressure damper:	Flange-mounted directly on the fuel tank.
Fuel accumulator:	Above the rear axle on the left.



Table of contents

Coordinates

1. Special features	H 2
2. Test specifications	H 3
3. Rapid diagnosis chart	H 7
4. Electrical circuit diagram	H 20
5. Diagram of fuel lines	H 22
6. Installation position of components	H 24



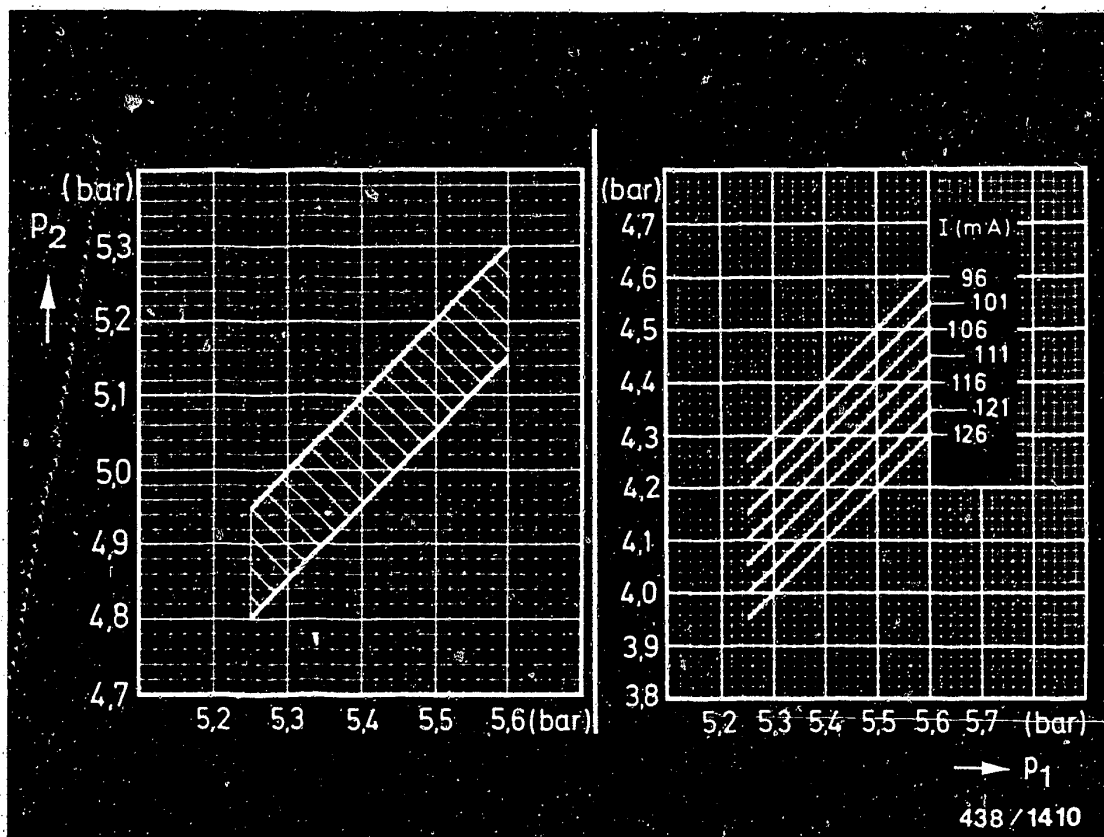
1. Special features

- Engine: 5 cyl., 2.3l
- KE-Jetronic with lambda closed-loop control, idle-speed control and altitude compensation.
- Air-shrouded injection valve (note the special connection for the tester for delivered quantity comparison).
- Active-carbon filter for recirculating gasoline vapors into the intake manifold.
- In-tank electric fuel pump (Audi 100,5000 only)

Basic microcard for detailed trouble-shooting:
AUDI-507.

Important note: In the case of references to a basic microcard, it should be noted that the test specifications should always be taken from the brief instructions for the specific vehicle concerned.





p_1 = Primary pressure
 p_2 = Lower chamber pressure

2. Test specifications

2.1 Differential pressure:

(Primary pressure/lower chamber pressure)

Obtain the specified value for "warm" lower chamber pressure from the left-hand diagram to correspond to the primary pressure as measured. Actuator current 10 mA.

Obtain the specified value "cold" lower chamber pressure from the right-hand diagram to correspond to the primary pressure as measured and the actuator current as measured.

Note: Tolerance + 0.15 bar

The "cold" condition is simulated by disconnecting the cable plug at the temperature sensor (NTC).



2.2 Electric fuel pump

Fuel delivery: min. 1050 cm³/min.

2.3 Primary pressure: 5.25 ... 5.6 bar
(5.35 ... 5.7 kgf/cm²)

2.4 Testing the fuel system as a whole for leaks:

Min. pressure after 10 min: 2.7 bar (2.8 kgf/cm²)

Min. pressure after 20 min: 2.6 bar (2.7 kgf/cm²)

2.5 Fuel-injection valves**

Opening pressure: 3.0 ... 4.1 bar
(3.1 ... 4.2 kgf/cm²)

2.6 Fuel distributor **

Comparative measurement of fuel deliveries:

Load range	Setting point	Max. allowable fuel delivery
Idle	6.0 cm ³ /min.	6.6 cm ³ /min.
Part load	40.0 cm ³ /min.	42.5 cm ³ /min.
Full load	100.0 cm ³ /min.	109.0 cm ³ /min.

Minimum delivery at all outlets with maximum deflection of air-flow sensor plate: 140.0 cm³/min.

Flow rate for KE throttle in fuel distributor: 130 ... 145 cm³/min.

** See next page!



**** Note on the part number for fuel-injection valves:**

The fuel injection valves installed in this engine have the part number 0 437 502 026 (original equipment) or ...027 (sales designation). These valves have an air-guide cap firmly pressed on (for the air shrouding system). For replacements, order valves with the above sales designation ...027 and not in accordance with the designation ..023 as stamped on the valve stem. Connection for the tester for comparison of fuel delivery using adapter sleeves KDJE-P 200/19.

2.7 Temperature sensor

Measurements of resistance:

Engine cold (+15°C...+30°C):	1300 ... 3600 Ω
Engine warm (approx. +80°C).	250 ... 390 Ω

2.8 Thermotime switch

Resistance measurements:

at a temperature

between

	Term. G and ground	Term. W and ground	Term. G and Term. W
below +30°C	25...40 Ω	0 Ω	25...40 Ω
above +40°C	50...80 Ω	100...160 Ω	50...80 Ω

2.9 Air-flow sensor potentiometer

Voltage signal with
air-flow sensor plate
in basic position:

0.01 ... 0.05 V

2.10 Basic setting of idle-mixture-adjusting screw

(fuel-distributor seat -
needle bearing)

21.2 ... 21,4 mm



2.11 Idle adjustment *

Idle speed (regulated by idle speed control):	$800 \pm 50 \text{ min}^{-1}$
On/off ratio to be set (bypass screw):	$28 \pm 1 \%$
Exhaust gas setting Pressure actuator trigger current.	
Checking value:	4 ... 16 mA
Setting:	9 ... 11 mA
CO level (check value):	0.3 ... 3.0 %

* Instructions for idle adjustment:

The exhaust gas setting is made automatically by the lambda closed-loop control. The object of the test is the triggering current for the pressure actuator in closed-loop control operation (pulsing of reading for current).

The setting should be adjusted to 9...11 mA by turning the idle-mixture-adjusting screw, but only if the reading lies outside the check value 4...16 mA. The CO check value is used to check whether or not there is a leak in the exhaust gas system. CO sampling at the exhaust-sample pipe on the right of the intake manifold. When checking the idle speed, switch off all electrical consuming devices and the air conditioner. The fan for the radiator must not be running. Disconnect the crankcase ventilation hose from the cylinder head cover and leave it open.



3. Rapid diagnostic chart for the universal test adapter ETT 018.01 with KE-Jetronic test lead 1 684 463 135 and a suitable multimeter:

The following rapid diagnosis chart makes it possible for the experienced Jetronic expert to quickly check the electrical/electronic peripheral and control-unit functions of the KE-Jetronic including lambda closed-loop control and idle-speed control.






Important instructions for the rapid diagnostic chart below:

The column "test conditions" shows those test steps at which the control unit must be plugged in or disconnected. In this regard, make absolutely certain that there is no electricity in the system when plugging in or disconnecting, i.e. it is not permissible to jump the electrical safety circuit, and the ignition must be switched off.

The column "test connections" shows the cables incorporated in the relevant test path with reference to the allocations in the control unit cable plug. Any necessary trouble-shooting refers to these cables.



Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position		But-ton	Under test	Test connections	Test conditions	Test speci-fications (Reading)
	V	Ω					
1		4	-	Internal resistance of pressure actuator	12 - 10	Disconnect control-unit plug.	20 ... 30 Ω
2		5	-	Internal resistance of temperature sensor	21 - 2	Control-unit plug disconnected. +15°C...+30°C: approx. +80°C:	1.3 ... 3.6k Ω 250 ... 390 Ω
3		11	-	Control unit output stage ground	20 - 2	Control-unit plug disconnected.	0 ... 10 Ω
4		9	-	"Idle" throttle-valve switch	13 - 2	Caution: Voltage measurement; connection of voltmeter: Negative = black socket "V" Positive = left-hand blue socket " Ω " Control-unit plug disconnected. Switch on ignition. Throttle valve closed: Open throttle valve by hand:	8 ... 15 V 0 V
5		10	-	"Full-load" throttle-valve switch	5 - 2	Caution: Voltage measurement; connection of voltmeter: Negative = black socket "V" Positive = left-hand blue socket " Ω " Control-unit plug disconnected. Switch on ignition. Throttle valve closed: Open throttle valve fully:	0 V 8 ... 15 V
6	3	-	-	Air conditioner signal (A/C ready-ness)	16 - 2	Control-unit plug disconnected. Switch on ignition. Switch on air conditioner.	8 ... 15 V
7	4	-	-	Starting signal terminal 50 -	24 - 2	Control-unit plug disconnected. Operate starting motor:	8 ... 15 V

H8

Rapid diagnosis chart
Audi/VW



H9

Rapid diagnosis chart
Audi/VW



Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position		But-ton	Under test	Test connec-tions	Test conditions	Test speci-fications (Reading)
	V	Ω					
8	5	-	-	TD signal (ignition)	25 - 2	Control-unit plug disconnected. Operate starting motor for a few seconds:	Voltage reading unde-fined
9	6	-	-	Control unit power supply	1 - 2	Control-unit plug disconnected. Switch on ignition.	8 ... 15 V
10	7	-	-	Power supply to po-tentiometer on air-flow sensor and pressure sensor (altitude sensor)	18 - 2	Switch off ignition. Connect control unit. Switch on ignition.	7 ... 8 V
11	8	-	-	Signal from potentio-meter on air-flow sensor	17 - 2	Control unit connected. Switch on ignition. Raise sensor flap by hand, voltage rise to max. 8 V.	0 ... 8 V
12	10	-	-	Idle actuator - power supply and continuity of winding 1	3 - 2	Switch off ignition. Disconnect control-unit plug. Switch on ignition.	8 ... 15 V
13	11	-	-	Idle actuator - continuity of winding 2	4 - 2	Control-unit plug disconnected. Switch on ignition.	8 ... 15 V
14	12	-	-	Air conditioner compressor signal	19 - 2	Switch off ignition. Connect control unit. Start engine. Switch on air conditioner. A/C compressor not operating: A/C compressor operating:	0 V 8 ... 15 V

H10

Rapid diagnosis chart
Audi/VW



H11

Rapid diagnosis chart
Audi/VW



Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position		But-ton	Under test	Test connec-tions	Test conditions	Test speci-fications (Reading)
	V	Ω					
15	13	-	-	Altitude sensor signal	11 - 2	Control unit connected. Switch on ignition. Signal is altitude-dependent: 0 metres (sea level) 500 metres 1000 metres 1500 metres 2000 metres 3000 metres	approx.6.5 V approx.5.6 V approx.4.8 V approx.4.0 V approx.3.2 V approx.2.0 V
16	14	24	-	Lambda closed-loop control - closed-loop operation	23 - 2	Control unit connected. Jump sockets 1 and 2 on test adapter. Start engine and warm up. Closed-loop operation: Pulsating voltage reading. Average value:	approx.3.0 V
17	-	-	1	Warm-up enrichment -20°C	12 - 12	Current measurement! Connection of measuring equipment: Negative = black socket 1 Positive = black socket 2 Control unit connected. Disconnect plug from altitude sensor. Switch on ignition.	61 ...81mA
18	-	-	2	Actuator current corresponding to engine at normal operating temperature	12 - 12	Control unit connected. Plug disconnected from altitude sensor. Switch on ignition.	9 ... 11 mA
19	-	-	2/4	Starting enrichment	12 - 12	Control unit connected. Plug disconnected from altitude sensor. Switch on ignition. Keep button 2 pressed. By pressing button 4 current rises - approx. 1 second - to:	70 ... 90mA

H12

Rapid diagnosis chart

Audi/VW



H13

Rapid diagnosis chart

Audi/VW



Rapid diagnosis chart for universal test adapter ETT 018.01

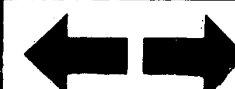
Test step	Switch position		But-ton	Under test	Test connec-tions	Test conditions	Test speci-fications (Reading)
	V	Ω					
20	-	-	1/4	Post-start enrich-ment	12 - 12	Control unit connected. Plug disconnected from altitude sensor. Switch on ignition. Keep button 1 pressed: Press button 4. Current rises to: After briefly remaining steady, cutback to: Cutback time approx. 30 seconds.	61...81 mA 140...160mA 61...81 mA
21	-	-	1	Acceleration enrich-ment	12 - 12	Control unit connected. Switch on ignition. Keep button 1 pressed. Current reading: Open throttle valve slightly. Deflect sensor flap quickly. Current rises to: Cutback after approx. 1 second to:	61...81 mA 140...160mA 61... 81mA
22	-	-	2	Overrun cutoff	12 - 12	Control unit connected. Reverse terminals on ammeter (swap positive and negative). Start engine and hold by hand at 1800...2000 min ⁻¹ . Suddenly bring engine to idle speed. Current reading briefly: With cruise control on, there must be no overrun cutoff.	-40...-70mA
23	-	24	-	Lambda closed-loop control	12 - 12 (8 - 2)	Disconnect plug from altitude sensor. Control unit connected. Start engine, warm up and run at idle speed. Closed-loop operation of lambda closed-loop control can be recognized by the pulsating current reading. Average value: If average value not within tolerance, adjust (idle-mixture-adjusting screw) to:	4...16mA 9...11mA

H14

Rapid diagnosis chart
Audi/VW


H15

Rapid diagnosis chart
Audi/VW



Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position		But-ton	Under test	Test connec-tions	Test conditions	Test speci-fications (Reading)
	V	Ω					
24	-	24	-	Lambda closed-loop control - Full-load correction	12 - 12 (8 - 2)	Switch off engine. Control unit connected. Plug disconnected from altitude sensor. Switch on ignition. Current reading: Open throttle valve fully. Current rises to:	9 ... 11mA 12 ... 14mA
25	-	22	-	Lambda closed-loop control - Rich stop	12 - 12 (8 - 2)	Control unit connected. Plug disconnected from altitude sensor. Switch on ignition. Current rises:	max. 22 mA
26	-	23	-	Lambda closed-loop control - Lean stop	12 - 12 (8 - 2)	Control unit connected. Plug disconnected from altitude sensor. Switch on ignition. Current drops to:	less than 2mA
27	10	-	-	Idle-speed control		Testing with lambda closed-loop tester KDJE-P 600. Press button "IR". Jump black sockets 1 and 2 on test adapter. Start engine, warm up and run at idle speed. Idle speed (regulated): With on/off ratio: Adjust on/off ratio if necessary (bypass screw on throttle assembly)	$800 \pm 20 \text{ min}^{-1}$ $28 \pm 1\%$

H16

Rapid diagnosis chart

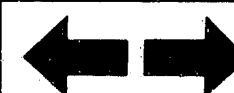
Audi/VW



H17

Rapid diagnosis chart

Audi/VW



Rapid diagnosis chart for universal test adapter ETT 018.01

Test step	Switch position		But-ton	Under test	Test connec-tions	Test conditions	Test speci-fications (Reading)
	V	Ω					
28	10	-	see text	Idle-speed control correction func-tions		Press button 6 (corresponds to opening of idle throttle-valve switch) Engine speed: On/off ratio:	900...940 min ⁻¹ 33 ± 1%
						Raising of engine speed with engine cold. (Test only with engine cold) Engine temperature less than +40°C:	980...1020 min ⁻¹
						Switch on air conditioner. Engine speed: A/C readiness. With on/off ratio: (A/C compressor not operating, selected temperature higher than actual temperature) A/C compressor on. With on/off ratio: (selected temperature lower than actual temperature)	900...940 min ⁻¹ 33 ± 1% approx.39%

H18

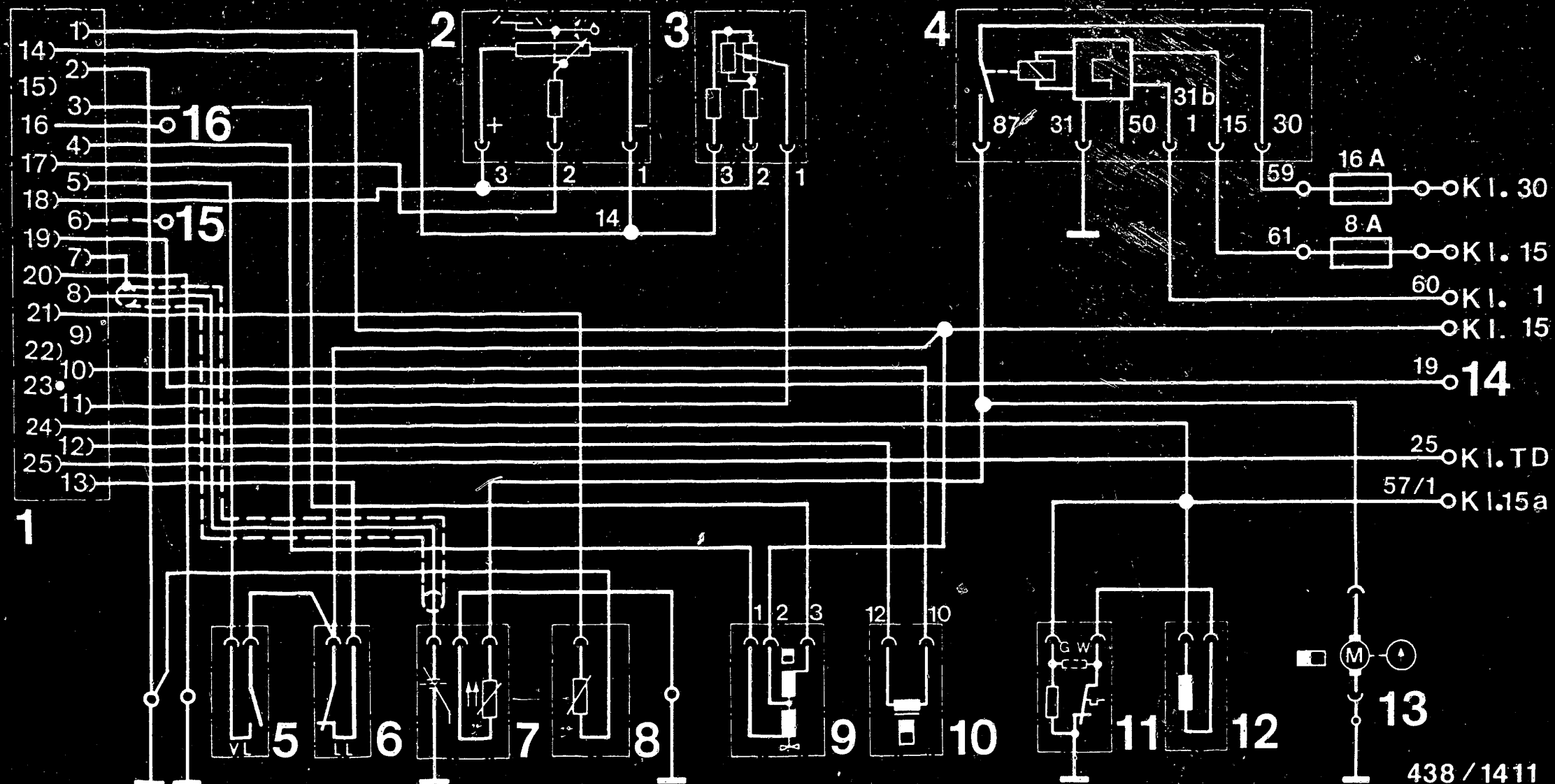
Rapid diagnosis chart
Audi/VW



H19

Rapid diagnosis chart
Audi/VW



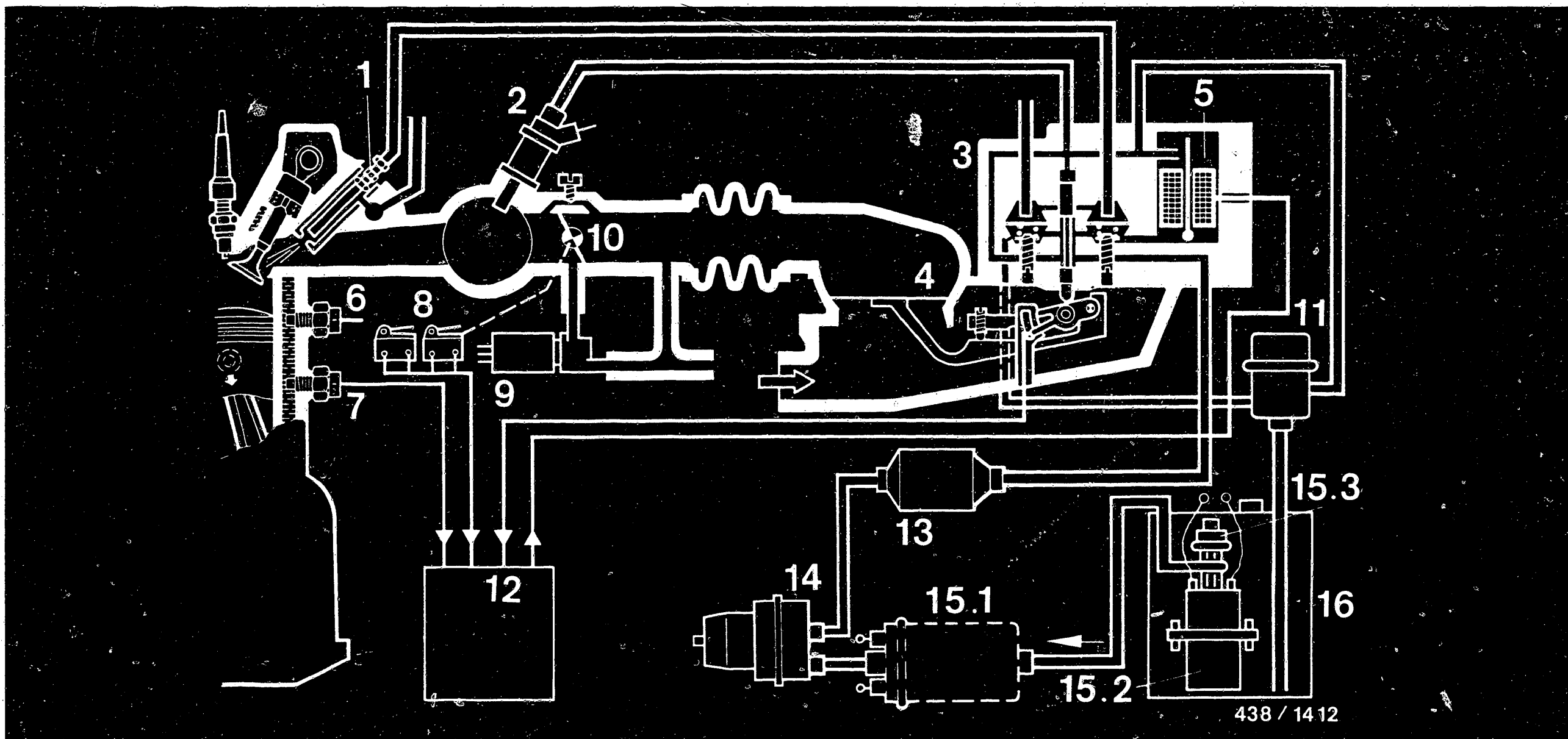


4. Electrical circuit diagram of KE-Jetronic with safety circuit:

- 1 = Control unit
- 2 = Air-flow sensor potentiometer
- 3 = Pressure sensor (altitude sensor)
- 4 = Electronic engine-speed relay
- 5 = Full-load throttle-valve switch
- 6 = Idle throttle-valve switch
- 7 = Lambda sensor with sensor heating
- 8 = Temperature sensor (NTC)

- 9 = Idle actuator
- 10 = Pressure actuator
- 11 = Thermo-time switch
- 12 = Start valve
- 13 = Electric fuel pump
- 14 = Lead to air conditioner (compressor)
- 15 = Cruise control connection
- 16 = Air conditioner readiness





5. Diagram of fuel lines and air guiding - KE-Jetronic

- 1 = Injection valve
- 2 = Start valve
- 3 = Fuel distributor
- 4 = Air-flow sensor
- 5 = Electrohydraulic pressure actuator
- 6 = Thermo-time switch
- 7 = Temperature sensor (NTC)
- 8 = Idle/full-load throttle-valve switches

- 9 = Idle actuator
- 10 = Throttle valve
- 11 = Pressure regulator (primary pressure)
- 12 = Control unit
- 13 = Fuel filter
- 14 = Fuel accumulator
- 15.1 = Electric fuel pump
(Audi 90, Coupe, 4000)

- 15.2 = In-tank electric fuel pump
(Audi 100, 5000)
- 15.3 = Pressure damper
(Audi 100 only)
- 16 = Fuel tank

H22

Diagram of fuel lines; air guiding
Audi/VW



H23

Diagram of fuel lines; air guiding
Audi/VW



6. Installation position of components

Mixture-control unit, primary-pressure regulator:	On right-hand inside fender.
Injection valves:	On intake-port flanges.
Start valve:	On intake manifold near throttle assembly.
Throttle-valve switches:	On throttle assembly, idle at bottom, full-load at top.
Idle actuator:	Above cylinder head, in region of throttle assembly.
Thermo-time switch:	Rear end face of cylinder head, at water fitting.
Temperature sensor:	In coolant fitting, on left on engine.

* Audi 100/5000 only

Control unit:	Behind right-hand footwell panel.
In-tank electric fuel pump	
Fuel accumulator:	On underside of vehicle on left in region in front of rear axle.
Fuel filter:	In engine compartment on right, on spring-strut crown.

* Audi 90/Coupe/4000, VW Quantum only

Control unit:	Mounted on glove compartment on right and accessible only after removing the glove compartment.
Electric fuel pump, fuel accumulator, fuel filter:	On underside of vehicle on left, in region in front of rear axle.



TABLE OF CONTENTS

<u>Section</u>	<u>Coordinates</u>
1. Special features	J 2
2. Test specifications	J 3
3. Electrical safety circuit	J 8
4. Diagram of fuel lines	J 12
5. General safety instructions	J 14
6. Idle stabilization and overrun cutoff	J 15
7. Installation position of components	J 18



1. SPECIAL FEATURES

- Injection valves with fixed air-guide caps. The air shrouding improves the mixture formation, particularly at idle. Air distribution is in the cylinder head. For measuring the scatter of the fuel distributor with the tester for delivered-quantity comparison, it is necessary to use adapters KDJE-P 200/19 for connection of the injection valves.
- Fuel accumulator with 40 cm³ storage volume.
- Warm-up regulator for intake-manifold-pressure-dependent full-load enrichment.
- Pulse relay for energization of start valve for hot starting.
- Pressure-jump switch for cold acceleration enrichment.
- Overrun cutoff and idle stabilization.

Audi 100/200 only:

- In-tank electric fuel pump

Basic microcard for detailed trouble-shooting:
AUD-01/J2



2. TEST SPECIFICATIONS

Test step

2.1 Electric fuel pump 0 580 254 959/960
 0 580 254 003/004

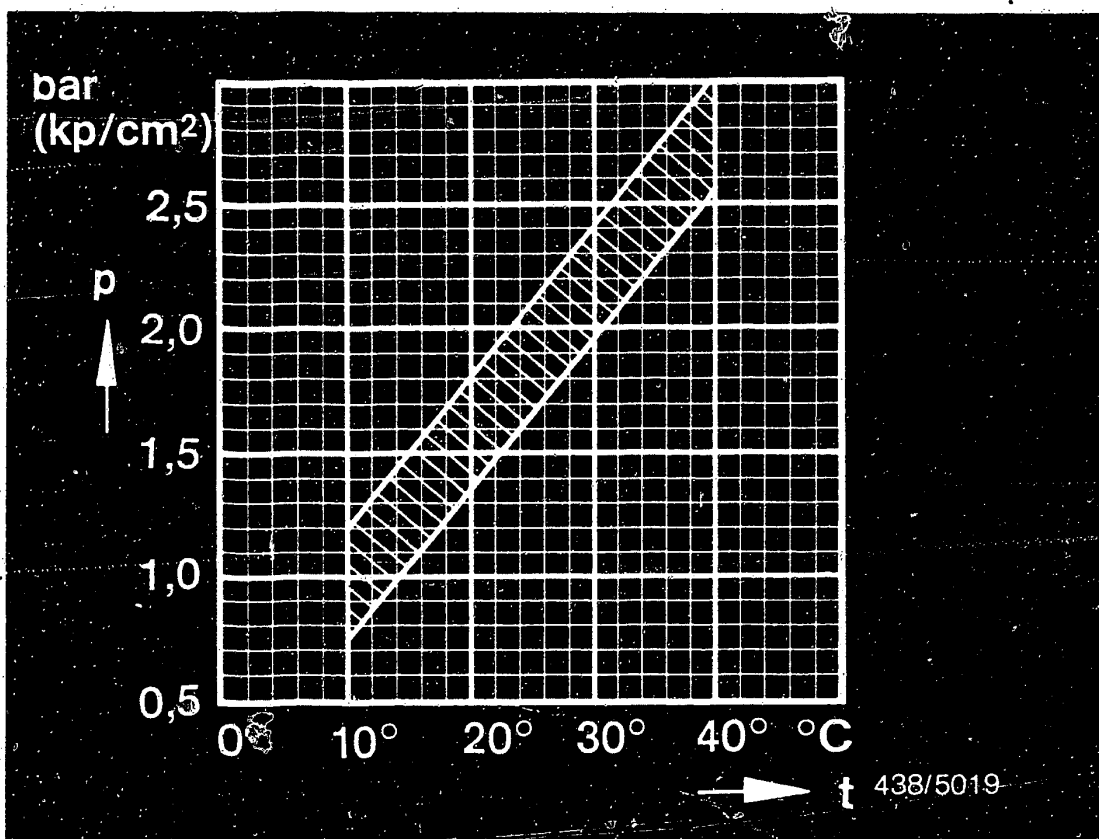
- Fuel delivery: min. 800 cm³/30 s
- Terminal voltage: min. 11.5 V
 under load

2.2 Fuel distributor 0 438 100 125

● Primary pressure	Checking value	Setting value
	4.7...5.4 bar* (4.8...5.5 kp/cm ²)*	4.9...5.1 bar* (5.0...5.2 kp/cm ²)*

* Gauge pressure





p = Control pressure (gauge pressure)
 t = Ambient temperature

2.3 Warm-up regulator

0 438 140 138/139

(Version with separate full-load enrichment)

- Fuel delivery for control pressure circuit
160...240 cm³/min

● Control pressure "cold"

For testing, connect vacuum pump to intake-manifold pressure connection of warm-up regulator.

Setting value: 400...600 mbar
 (300...450 mmHg)



Test step

● Control pressure "warm"

Warm-up regulator 0 438 140 138/139
(Version with separate full-load enrichment)

● Test with atmospheric pressure (without vacuum)

2.6...3.0 bar*
(2.7...3.1 kp/cm²)*

● For testing, connect vacuum pump to intake-manifold pressure connection of warm-up regulator.

Setting values:
400...600 mbar 4.0...4.4 bar*
(300...450 mmHg) (4.1...4.5 kp/cm²)*

● Leak test on full-load diaphragm

Max. allowable pressure drop
from setting value: 100 mbar (75 mmHg)/15s

2.4 Fuel accumulator

0 438 170 040/041

● Leak test

Minimum pressure

after 10 min.

after 20 min.

2.5 bar*
(2.6 kp/cm²)*

2.4 bar*
(2.5 kp/cm²)*

* Gauge pressure

J5

Test specifications

AUDI 90, 100, 200 Quattro



Test step

2.5 Injection valves

0 437 502 026/027

- Opening pressure:

3.0...4.1 bar*
(3.1...4.2 kp/cm²)*

- Leak test not below
2.8 bar*:

No drop may fall within
25s

2.6 Fuel distributor

0 438 100 125

- Comparative measurement of fuel deliveries:

Setting point		max. allowable delivery
Idle	6.0 cm ³ /min	6.6 cm ³ /min
Part load	40.0 cm ³ /min	43.0 cm ³ /min
Full load	118.0 cm ³ /min	130.0 cm ³ /min
This delivery must be obtained at least at each outlet.		

* Gauge pressure

J6

Test specifications

AUDI 90, 100, 200 Quattro



Test step

2.7 Thermo-time switch

0 280 130 214/223

- Resistance measurement between

At temperature below above °C °C	Term. "G" and "ground" (housing)	Term. "W" and "ground" (housing)	Term. "G" and term. "W"
+30	25...40 Ω	0 Ω	25...40 Ω
+40	50...80 Ω	100...160 Ω	50...80 Ω

2.8 Idle adjustment *

- Idle speed: 750...850 min⁻¹

07.82 - 06.83:

Actuator current setting: 440...500 mA
(at idle bypass adjusting screw)

as of 07.83:

Disconnect double plug from ignition coil terminal 1
and connect so that the lead to the idle stabilization
control unit remains free.

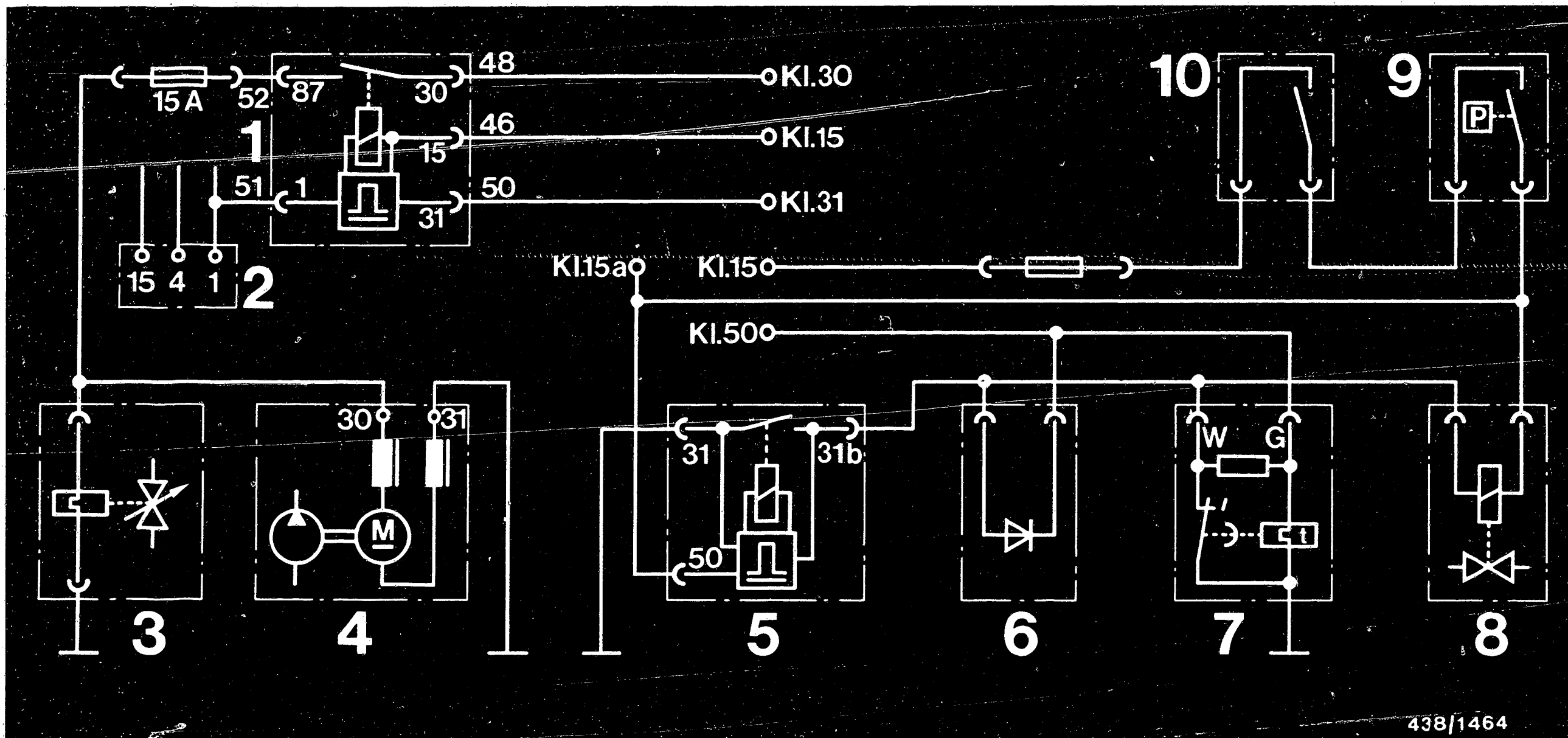
Adjust the idle speed at the idle bypass adjusting
screw.

- CO concentration: 0.5...1.5 Vol.%

- * For idle adjustment/checking:

Switch off air conditioner. Engine at normal
operating temperature, oil temperature approx. +80°C.





- 1 = Electronic relay
- 2 = Ignition coil
- 3 = Warm-up regulator
- 4 = Electric fuel pump

- 5 = Pulse relay
- 6 = Blocking diode
- 7 = Thermo-time switch

- 8 = Start valve
- 9 = Pressure-jump switch
- 10 = Throttle-valve switch

3. ELECTRICAL SAFETY CIRCUIT WITH COLD ACCELERATION ENRICHMENT

3.1 Circuit diagram

- o The safety circuit with electronic relay is energized from terminal 1 of the ignition coil
- o Cold-acceleration enrichment below +35°C by start valve, triggered by pressure-jump switch and throttle-valve idle switch.

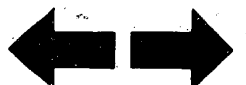
J8

Electrical safety circuit
AUDI 90, 100, 200 Quattro

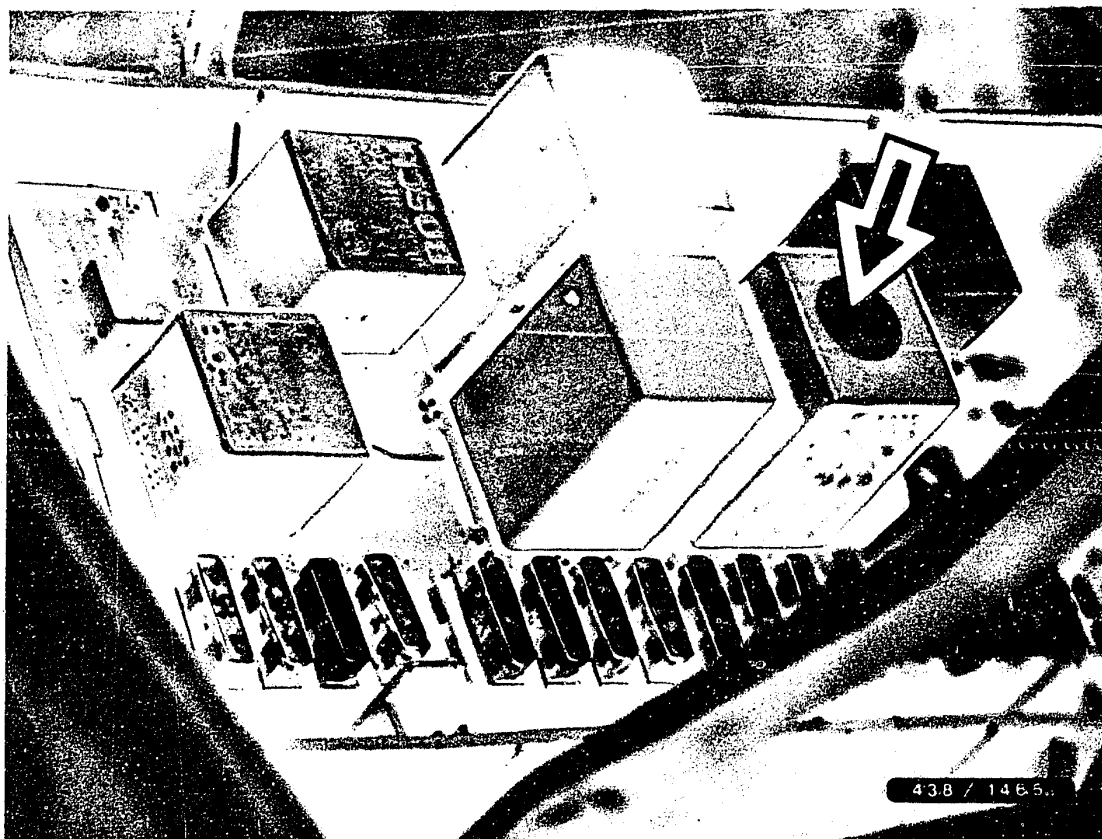


J9

Electrical safety circuit
AUDI 90, 100, 200 Quattro



438/1464



Arrow = Electronic relay

3.2 Jumping the safety circuit

In order to perform the testing operations with the engine stopped, it is necessary to jump the safety circuit.

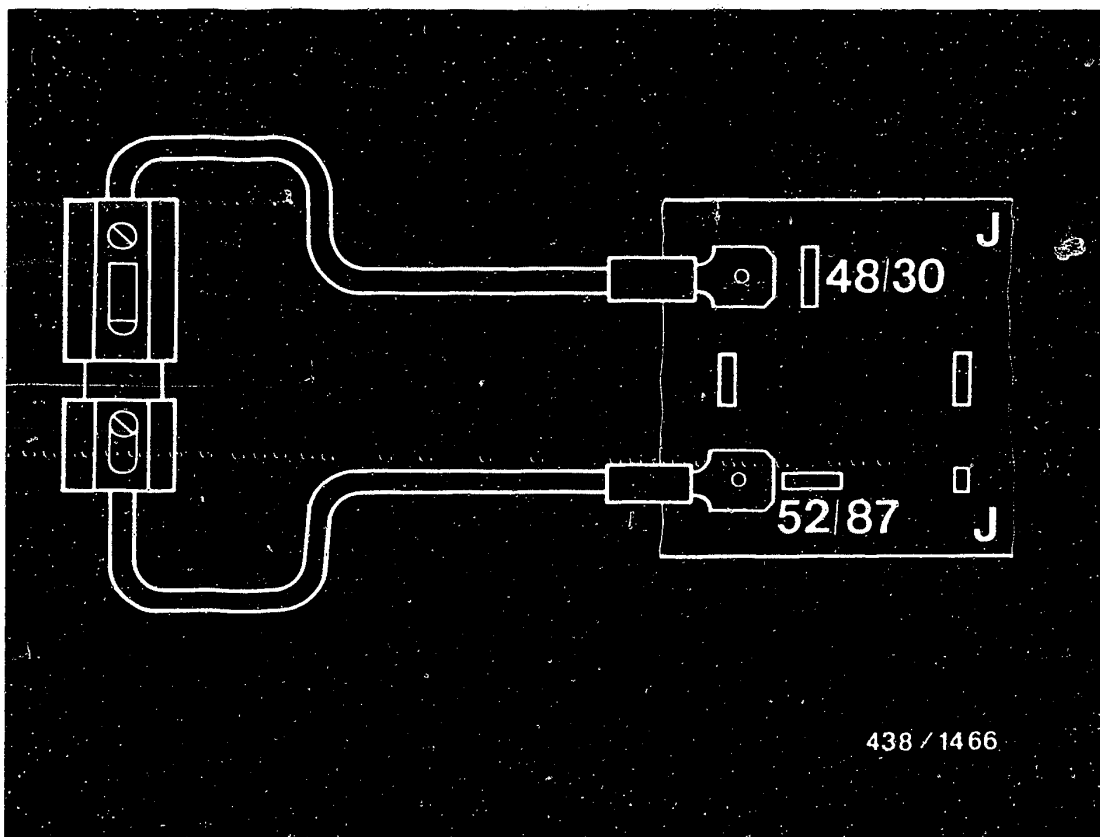
To do this, pull relay (in central-electrics box in engine compartment on left in front of windshield) out of the relay board.

On the Audi 90/Audi Coupe the central-electrics box is under the instrument panel on the left.

J10

Electrical safety circuit
AUDI 90, 100, 200 Quattro





Using a jumper, connect contacts J 48/30 and J 52/87 in the relay board.

Use connecting lead 1.5 mm² with fuse holder and 16 A fuse.

Width of blade terminal: 9.5 mm

(To be user-fabricated as per sketch).

Electric fuel pump and warm-up regulator are supplied with battery voltage via this jumper.

C A U T I O N :

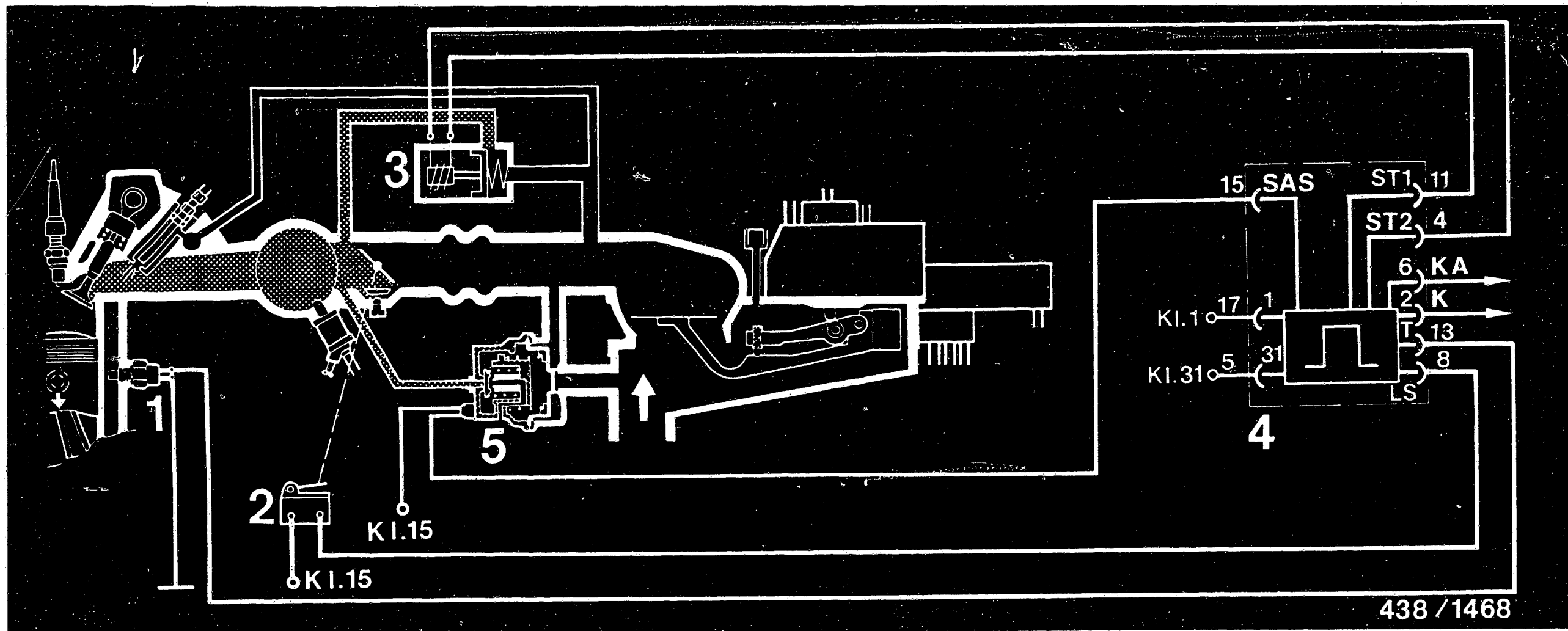
Never deflect (raise) the air-flow sensor plate with the electric fuel pump operating since otherwise fuel will be injected. Subsequent operation of the starting motor may lead to serious engine damage.



5. GENERAL SAFETY INSTRUCTIONS FOR WORKING ON THE K-JETRONIC

- Never deflect (raise) the air-flow sensor plate with the electric fuel pump operating since fuel will be injected through the injection valves.
Subsequent operation of the starting motor may lead to serious engine damage.
- Note regulations on test media when testing the injection valves with valve tester.
Never perform test with normal gasoline for other easily inflammable liquids.
Even when using test gasoline, observe the local safety regulations.
- Leak test on engine intake system to be performed only with allowable leak detector spray (e.g. Gypoflex).
Do not use any easily inflammable liquids. Observe local safety regulations.





1 = Thermo-switch
2 = Throttle-valve microswitch

3 = Idle actuator
4 = Control unit for idle stabilization
and overrun cutoff

5 = Overrun-cutoff valve

6. IDLE STABILIZATION AND OVERRUN CUTOFF (NON-BOSCH PRODUCT)

The control unit for the idle stabilization and overrun cutoff is on the auxiliary relay board under the instrument panel on the left.

6.1 Operating principle of idle stabilization

The idle speed is stabilized by the electronic control unit and the idle actuator. The otherwise customary auxiliary-air device is replaced by the idle actuator in the air bypass around the throttle valve.

From the control unit the tractive electromagnet of the idle actuator receives a variably pulsed voltage of constant frequency. This adjusts the plate in the air duct and changes the air throughput.

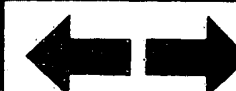
J15

Idle stabilization
AUDI 90, 100, 200 Quattro



J16

Idle stabilization
AUDI 90, 100, 200 Quattro



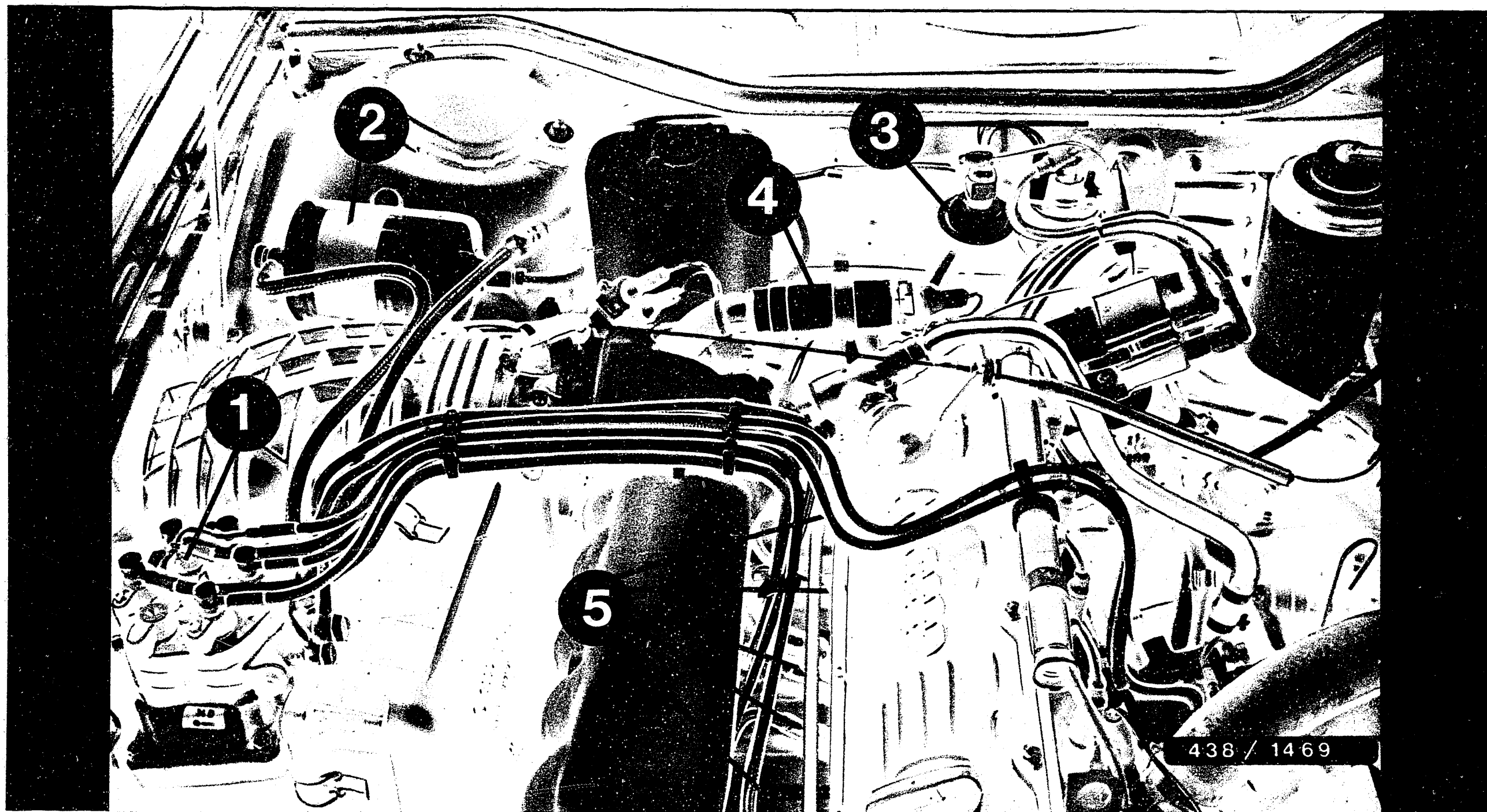
6.2 Operating principle of overrun cutoff

The control valve of the overrun-cutoff valve is connected to term. 15 and to term. 15/SAS of the control unit. Under the following conditions the control valve receives ground connection through term. 15/SAS of the control unit:

- The coolant temperature is less than $+30^{\circ}\text{C}$
- The engine speed is greater than 1200 min^{-1}
- The throttle-valve switch is in the idle position.

If these conditions are met, the overrun-cutoff valve opens the air bypass duct.





7. INSTALLATION POSITION OF COMPONENTS

7.1 Arrangement of components in engine compartment

1 = Mixture-control unit
2 = Fuel filter

3 = Pressure-jump switch
4 = Idle actuator

5 = Injection valve

J18

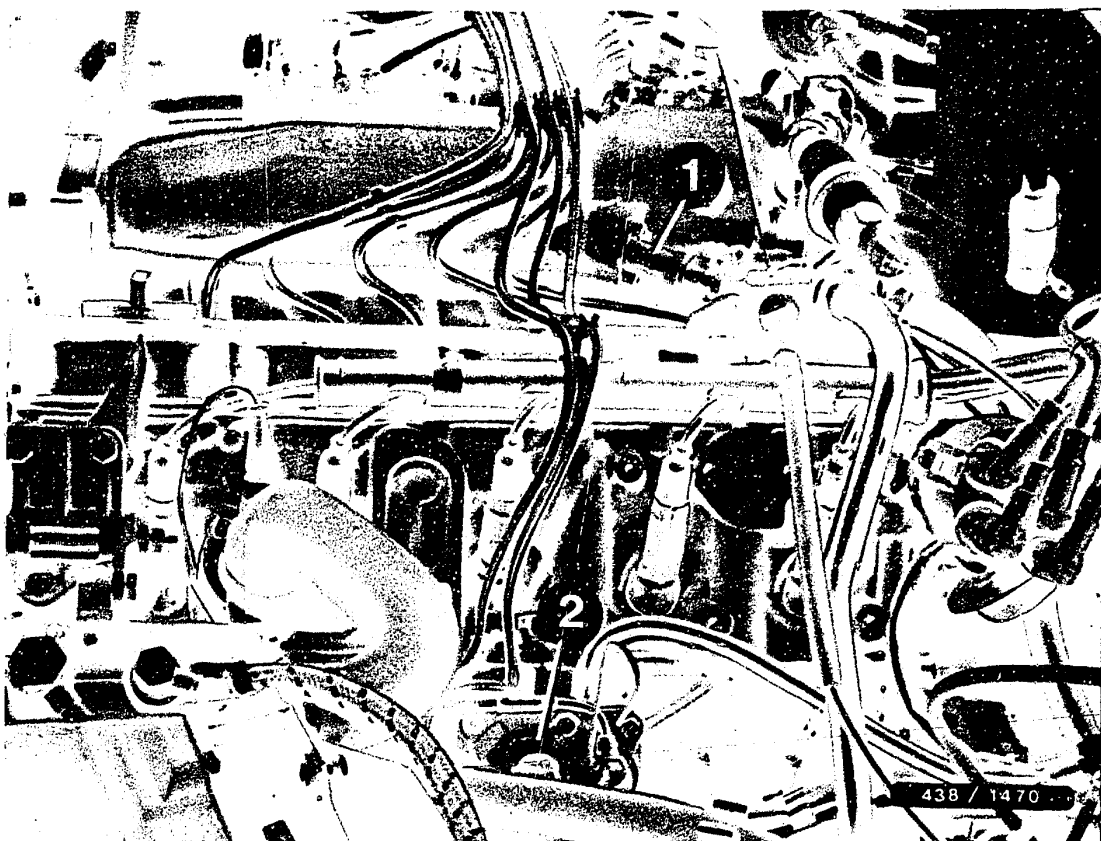
Installation position of components
AUDI 90, 100, 200 Quattro



J19

Installation position of components
AUDI 90, 100, 200 Quattro



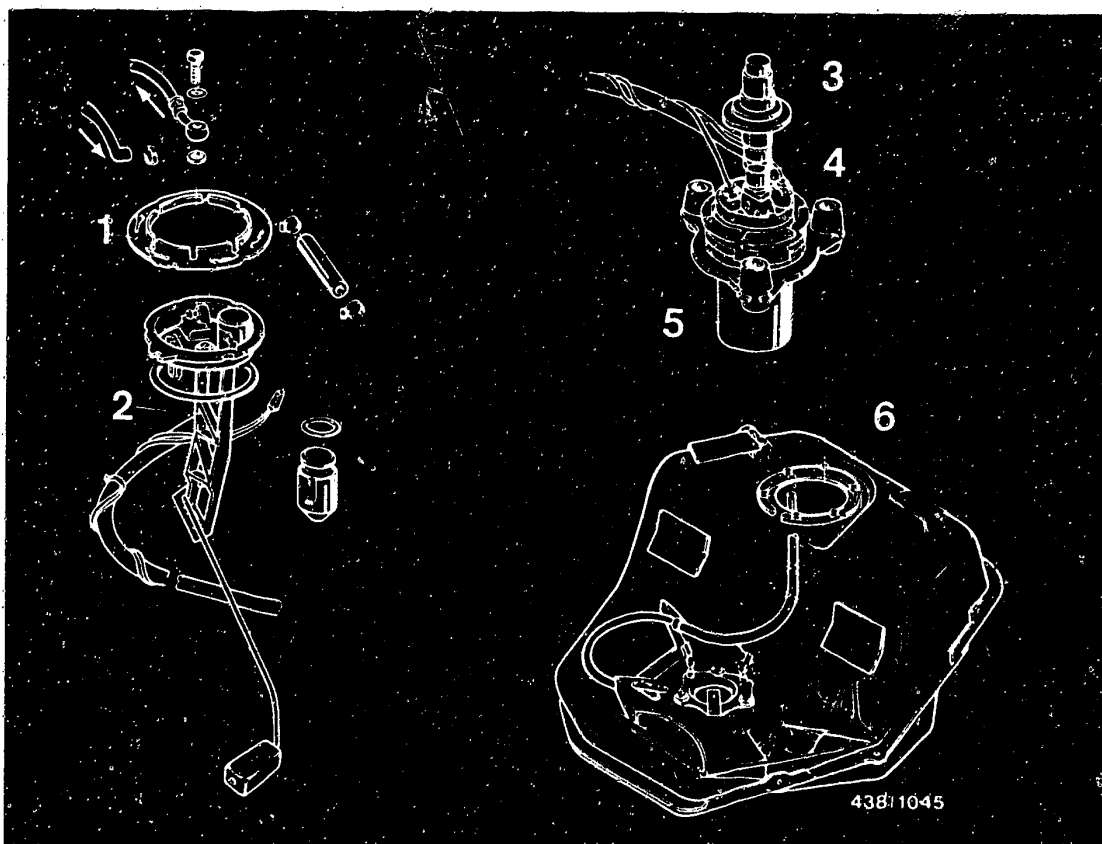


- 1 = Start valve
- 2 = Warm-up regulator

J20

Installation position of components
AUDI 90, 100, 200 Quattro





- 1 = Closure ring
- 2 = Sender for fuel gauge
- 3 = Pressure damper

- 4 = Non-return valve
- 5 = Electric fuel pump
- 6 = Fuel tank

7.2 Fuel-supply components

The in-tank electric fuel pump with replaceable non-return valve and screwed-on pressure damper is accessible through the closure ring on the top side of the fuel tank (Audi 100/200).



The fuel accumulator is mounted by a bracket to the underside of the vehicle on the right in front of the fuel tank.

On the Audi 90 / Coupé the electric fuel pump is also in this location.

Before replacing these components, clean the connections thoroughly.



Table of contents

1. Special features	K 2
2. Test specifications	K 3
3. Rapid diagnosis chart	K 7
4. Electric wiring diagram	K 18
5. Fuel line diagram	K 20
6. Installation position of components	K 22



1. Special features

This microcard contains the KE-Jetronic trouble-shooting instructions for the following models valid at the time of printing:

Audi 80 Quattro (D) 4.85 →
Audi 100 Quattro (D) 4.85 →

Engine: 4-cyl. - 1.8 l 66 kW/90 HP (DIN)

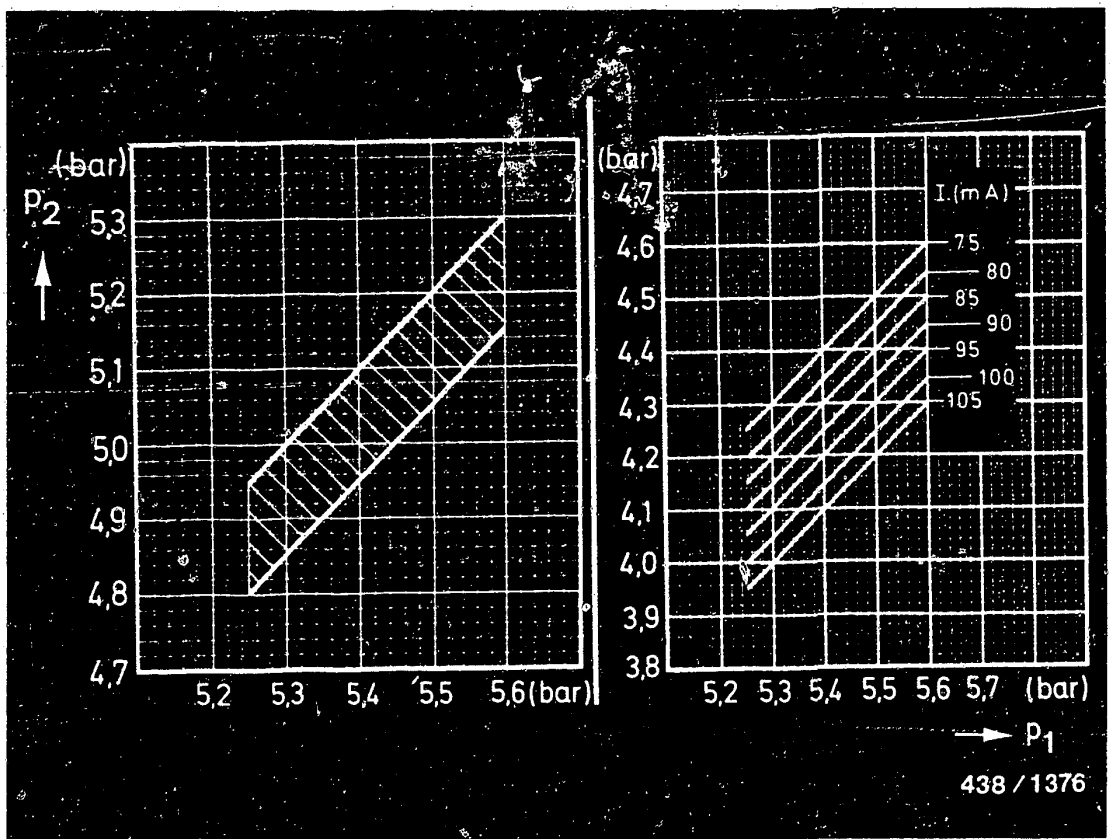
The KE-Jetronic in these models corresponds to the basic version with the following additional functions/special features:

- Lambda closed-loop control
- Overrun cutoff
- Injection valves with air-guide sleeves for air shrouding (note the special connection technique for the tester for delivered-quantity comparison).

Basic microcard for detailed trouble-shooting:
AUD-507.

Important: If referred to a basic microcard, remember that the test specifications must be taken always from the vehicle-related brief instructions.





p_1 = Primary pressure
 p_2 = Lower chamber pressure

2. Test specifications

2.1 Differential pressure:

(Primary pressure/lower chamber pressure)

Obtain the specified value for "warm" lower chamber pressure from the left-hand diagram to correspond to the primary pressure as measured. Actuator current 10 mA.

Obtain the specified value "cold" lower chamber pressure from the right-hand diagram to correspond to the primary pressure as measured and the actuator current as measured.

Note: Tolerance + 0.15 bar

The "cold" condition is simulated by disconnecting the cable plug at the temperature sensor (NTC).

K3

Test specifications

Audi



2.2 Electric fuel pump

Fuel delivery: min. 1000 cm³/min.

2.3 Primary pressure: 5.25 ... 5.6 bar
(5.35 ... 5.7 kgf/cm²)

2.4 Testing the fuel system as a whole for leaks:

Min. pressure after 10 min: 2.7 bar (2.8 kgf/cm²)

Min. pressure after 20 min: 2.6 bar (2.7 kgf/cm²)

2.5 Fuel-injection valves**

Opening pressure: 3.0 ... 4.1 bar
(3.1 ... 4.2 kgf/cm²)

2.6 Fuel distributor **

Comparative measurement of fuel deliveries:

Load range	Setting point	Max. allowable fuel delivery
Idle	6.0 cm ³ /min.	6.6 cm ³ /min.
Part load	40.0 cm ³ /min.	42.5 cm ³ /min.
Full load	91.0 cm ³ /min.	100.0 cm ³ /min.

Minimum delivery at all outlets with maximum deflection of air-flow sensor plate:

91.0 cm³/min.

Flow rate for KE throttle in fuel distributor:

130 ... 145 cm³/min.

** See next page!



**** Note on the part number for fuel-injection valves:**

The fuel injection valves installed in this engine have the part number 0 437 502 026 (original equipment) or ...027 (sales designation). These valves have an air-guide cap firmly pressed on (for the air shrouding system). For replacements, order valves with the above sales designation ...027 and not in accordance with the designation ..023 as stamped on the valve stem. Connection for the tester for comparison of fuel delivery using adapter sleeves KDJE-P 200/19.

2.7 Temperature sensor

Measurements of resistance:

Engine cold (+15°C...+30°C):	1300 ... 3600 Ω
Engine warm (approx. +80°C):	250 ... 390 Ω

2.8 Thermotime switch

Resistance measurements:

at a temperature

between

	Term. G and ground	Term. W and ground	Term. G and Term. W
below +30°C	25...40 Ω	0 Ω	25...40 Ω
above +40°C	50...80 Ω	100...160 Ω	50...80 Ω

2.9 Air-flow sensor potentiometer

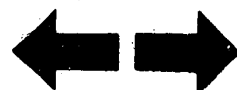
Voltage signal with
air-flow sensor plate
in basic position:

0.01 ... 0.05 V

2.10 Basic setting of idle-mixture-adjusting screw

(fuel-distributor seat -
needle bearing)

18.7 ... 18.9 mm



2.11 Idle adjustment

Idle speed:	800 ... 1000 min ⁻¹
Exhaust gas setting	
Pressure actuator trigger current.	
Checking value:	4 ... 16 mA
Setting:	9 ... 11 mA
CO level (check value):	0.3 ... 1.2 %

* Instructions for idle adjustment:

The exhaust gas setting is made automatically by the lambda closed-loop control. The object of the test is the triggering current for the pressure actuator in closed-loop control operation (pulsing of reading for current).

The setting should be adjusted to 9...11 mA by turning the idle-mixture-adjusting screw, but only if the reading lies outside the check value 4...16 mA. The CO check value is used to check whether or not there is a leak in the exhaust gas system. CO sampling at the exhaust-sample pipe on the right of the intake manifold. When checking the idle speed, switch off all electrical consuming devices and the air conditioner. The fan for the radiator must not be running. Disconnect the crankcase ventilation hose from the cylinder head cover and leave it open.



3. Rapid diagnostic chart for the universal test adapter
ETT 018.01 with KE-Jetronic test lead 1 684 463 135 and
a suitable multimeter:

The rapid diagnostic chart below makes it possible for the experienced Jetronic expert to check quickly the electrical/electronic peripheral and control unit functions of the KE-Jetronic, including the lambda closed-loop control.

Important instructions for the rapid diagnostic chart
below:

The column "test conditions" shows those test steps at which the control unit must be plugged in or disconnected. In this regard, make absolutely certain that there is no electricity in the system when plugging in or disconnecting, i.e. it is not permissible to jump the electrical safety circuit, and the ignition must be switched off.

The column "test connections" shows the cables incorporated in the relevant test path with reference to the allocations in the control unit cable plug. Any necessary trouble-shooting refers to these cables.



Rapid diagnostic chart for the universal test adapter ETT 018.01

Test step	Switch setting		But-ton	Object tested	Test connec-tions	Test conditions	Test specifi-cations (reading)
	V	Ω					
1	↓	4	-	Pressure actuator - internal resistance	12 - 10	Disconnect control unit plug.	12 ... 25 Ω
2	↓	5	-	Temperature sensor - internal resistance +15°C...+30°C approx. +80°C	21 - 2	Control unit plug disconnected.	1.3...3.6 k Ω 250...390 Ω
3	↓	11	-	Ground control unit - output stage	20 - 2	Control unit plug disconnected	0...10 Ω
4	↓	9	-	"Idle" throttle valve switch	13 - 2	N.B.: Measurement of voltage; connection for voltmeter: Negative = black socket "V" Positive = blue socket on left " Ω " Control unit plug disconnected. Switch on the ignition. Throttle valve closed: Open throttle valve by hand:	8 ... 15 V 0 V

K8

Rapid diag. chart for univ. test adapter
Audi



K9

Rapid diag. chart for univ. test adapter
Audi



Rapid diagnosis chart for universal test adapter ETT 018.01 (continued)

Test step	Switch position V	But- ton	Under test	Test con- nections	Test conditions	Test specifica- tions (reading)
5	3	-	Air conditioner signal (A/C readiness)	16 - 2	Control-unit plug disconnected. Switch on ignition. Switch on air conditioner.	8...15 V
6	4	-	Starting signal terminal 50	24 - 2	Control-unit plug disconnected. Operate starting motor:	8...15 V
7	5	-	TD signal (ignition)	25 - 2	Control-unit plug disconnected. Operate starting motor for a few seconds:	Voltage value undefined
8	6	-	Control unit power supply	1 - 2	Control-unit plug disconnected. Switch on ignition.	8...15 V
9	7	-	Power supply to potentiometer on air-flow sensor	18 - 2	Connect control unit. Switch on ignition.	7...8 V
10	8	-	Signal from potentiometer on air-flow sensor	17 - 2	Control unit connected. Switch on ignition. Raise sensor plate by hand; voltage rises to max. 8 V.	0...8 V

K10

Rapid diagnosis chart

Audi



K11

Rapid diagnosis chart

Audi



Rapid diagnosis chart for universal test adapter ETT 018.01 (continued)

Test step	Switch position V Ω	But-ton	Under test	Test con-nections	Test conditions	Test specifica-tions (reading)
11	12	-	-	Air conditioner com-pressor signal	19 - 2 Connect control unit. Start engine. Switch on air con-ditioner. Air conditioner compressor not operating: Air conditioner compressor operating:	0 V 8...15 V
12	14	24	-	Lambda closed-loop control - closed-loop mode	23 - 2 Control unit connected. Jump sockets 1 and 2 on test adapter. Start engine and warm up. Closed-loop operation: pulsating voltage reading. Average value:	approx. 3 V
13	-	-	1	Warm-up enrichment -20 °C	12 - 12 Current measurement: connection of measuring equipment negative = black socket 1 positive = black socket 2 Control unit connected Switch on ignition:	51...71 mA
14	-	-	2	Actuator current according to engine at normal operating temperature	12 - 12 Control unit connected. Switch on ignition:	9...11 mA

K12

Rapid diagnosis chart

Audi



K13

Rapid diagnosis chart

Audi



Rapid diagnosis chart for universal test adapter ETT 018.01 (continued)

Test step	Switch position V	But- ton Ω	Under test	Test con- nections	Test conditions	Test specifica- tions (reading)
15	-	-	1/4 Post-start enrichment	12 - 12	Control unit connected. Switch on ignition. Keep button 1 pressed: Press button 4. Current rises to: After briefly remaining steady, cutback to: Cutback time approx. 90 seconds.	51... 71 mA 130...150 mA 51... 71 mA
16	-	-	1/6 Acceleration enrichment	12 - 12	Control unit connected. Switch on ignition. Keep both buttons pressed. Current reading: Deflect sensor plate quickly. Current rises to: Cutback in approx. 1 second to:	51... 71 mA 130...150 mA 51... 71 mA
17	-	-	2 Overrun cutoff	12 - 12	Control unit connected. Swop over ammeter (swop over positive and negative) Start engine and hold at 1800...2000 min ⁻¹ . While button 2 pressed, actuate idle throttle-valve switch by hand. Engine hunts. Current reading during falling engine-speed phases: With cruise control on, there must be no overrun cutoff.	40...50 mA

K14

Rapid diagnosis chart

Audi



K15

Rapid diagnosis chart

Audi



Rapid diagnosis chart for universal test adapter ETT 018.01 (continued)

Test step	Switch position V	But- ton	Under test	Test con- nections	Test conditions	Test specifica- tions (reading)
18	-	24	-	Lambda closed-loop control	12 - 12 8 - 12 Control unit connected. Start engine, warm up and operate at idle speed. Closed-loop mode of the lambda closed-loop control can be recognized by the pulsating current reading. Average value: If average value not within tolerance, adjust (idle-mixture-adjusting screw):	4 ... 16 mA 9...11 mA
19	-	22	-	Lambda closed-loop control Rich stop	12 - 12 8 - 2 Control unit connected. Switch on ignition. Current rises to:	22 mA max.
20		23	-	Lambda closed-loop control - lean stop	12 - 12 8 - 2 Control unit connected Switch on ignition: Current drops to:	less than 2 mA

K16

Rapid diagnosis chart

Audi

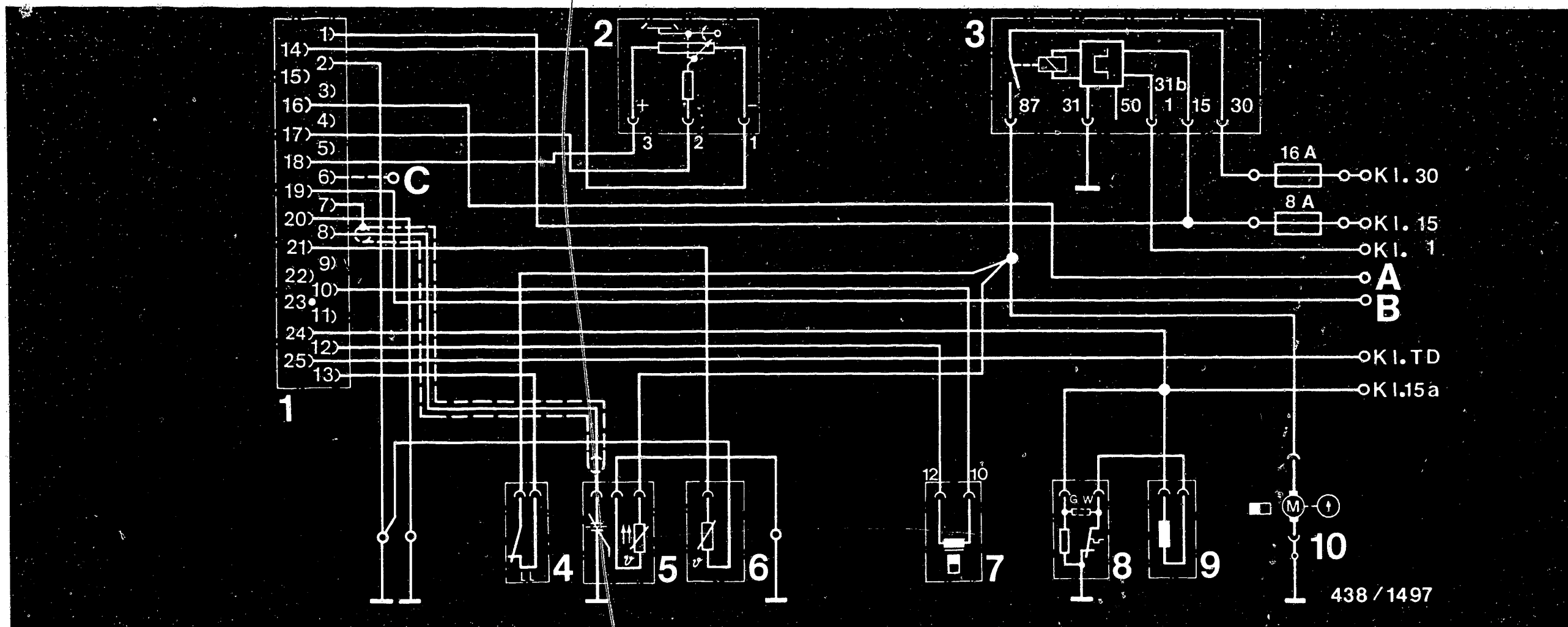


K17

Rapid diagnosis chart

Audi





4. Electrical circuit diagram of KE Jetronic with safety circuit

1 = Control unit
 2 = Air-flow sensor potentiometer
 3 = Electronic engine-speed relay
 4 = Idle throttle-valve switch
 5 = Lambda sensor with sensor heating
 6 = Temperature sensor (NTC)

7 = Pressure actuator
 8 = Thermo-time switch
 9 = Start valve
 10 = Electric fuel pump

A = Air conditioner lead (operator control)
 B = Lead to A/C compressor
 C = Cruise control connection

Jumping the safety circuit for pressure measurements:

Disconnect engine-speed relay (3) from relay base and connect terminals 30 and 87 with auxiliary lead.

Important: Operation of electric fuel pump required only for pressure measurements. For electrical tests, switch on ignition only.

K18

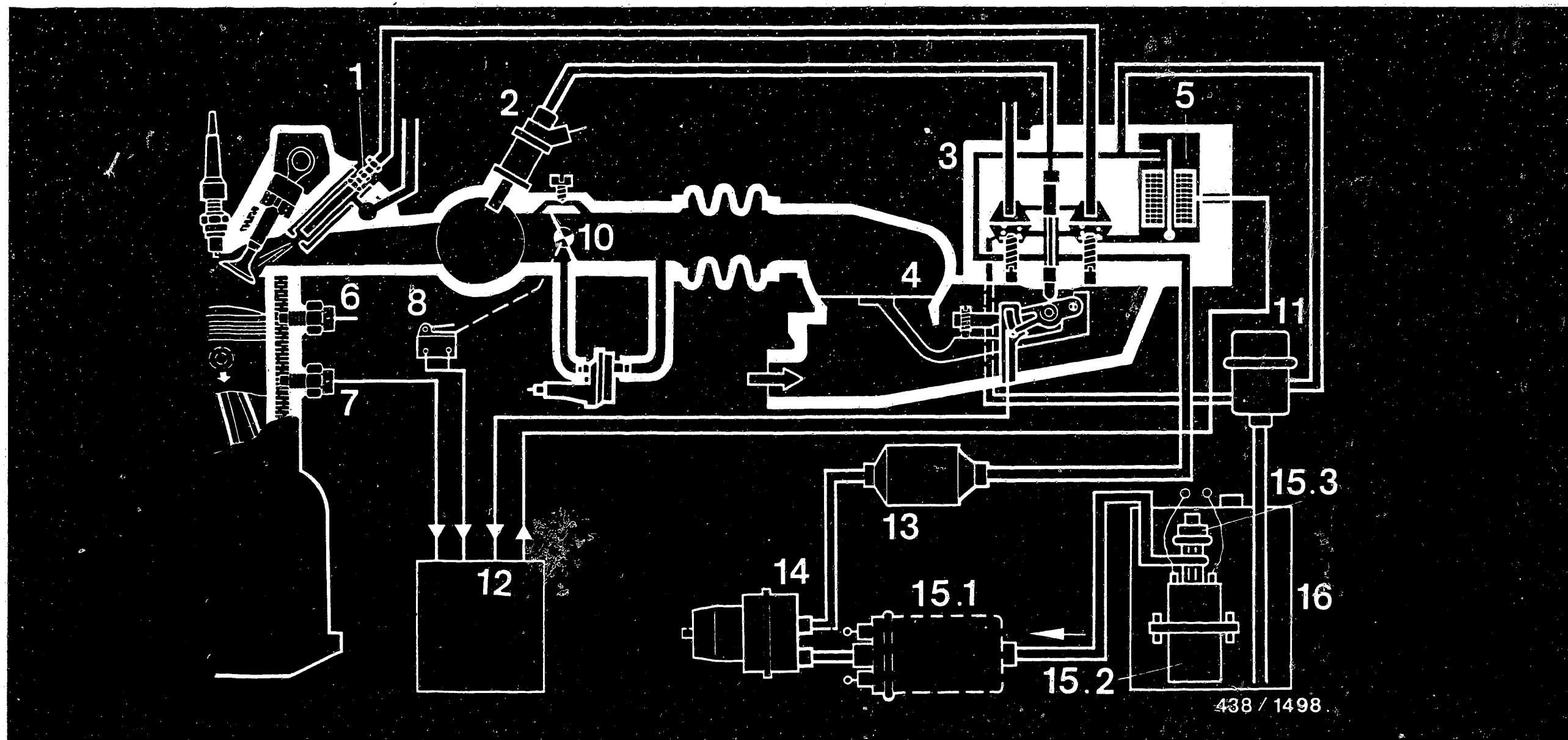
Electrical circuit diagram
Audi



K19

Electrical circuit diagram
Audi





5. Diagram of fuel lines and air guiding in KE-Jetronic

- 1 = Injection valve
- 2 = Start valve
- 3 = Fuel distributor
- 4 = Air-flow sensor
- 5 = Electro-hydraulic pressure actuator
- 6 = Thermo-time switch
- 7 = Temperature sensor (NTC)

- 8 = Idle throttle-valve switch
- 9 = Auxiliary-air device
- 10 = Throttle valve
- 11 = Pressure regulator (primary pressure)
- 12 = Control unit
- 13 = Fuel filter
- 14 = Fuel accumulator

- 15.1 = Electric fuel pump (Audi 80, Coupe)
- 15.2 = In-tank electric fuel pump (Audi 100)
- 15.3 = Pressure damper (Audi 100)
- 16 = Fuel tank

K20

Diagram of fuel lines, air guiding
Audi



K21

Diagram of fuel lines, air guiding
Audi



6. Installation position of components

Mixture-control unit, primary-pressure regulator:	On right-hand inside fender.
Injection valves:	On intake-port flanges.
Start valve:	On intake manifold near throttle-valve assembly.
Throttle-valve switch:	On throttle-valve assembly, underside.
Auxiliary-air device:	Under throttle-valve assembly.
Temperature sensor, thermo-time switch:	In coolant fitting, on engine on left.

* Audi 100 Quattro only

Control unit: ↗	Behind right-hand footwell panel.
In-tank electric fuel pump	
Fuel accumulator:	On underside of vehicle on left in front of rear axle.
Fuel filter:	In engine compartment on right, on spring- strut crown.

* Audi 80 Quattro only

Control unit:	Mounted on glove compartment on right and accessible only after removing glove compartment.
Electric fuel pump, fuel accumulator, fuel filter:	On underside of vehicle on left, in front of rear axle.



TABLE OF CONTENTS











Section

Coordinates

1. Rapid diagnosis chart for universal
test adapter L 2
2. Test specifications L 10
3. Electrical terminal diagram L 12
4. Diagram of fuel lines L 14
5. Important general information L 15
6. Special emission control systems
(Sweden, Switzerland, Australia models) L 17
7. Installation position of individual
components L 23



1. RAPID DIAGNOSIS CHART FOR UNIVERSAL TEST ADAPTER 0 684 101 801 WITH ADAPTER LEAD 1 684 463 124.
Valid for control units 0 261 200 011, 0 261 200 040, 0 261 200 041, 0 261 200 043 (S/CH/AUS)

Test step	Switch position		Remarks	Test specifications (reading)
	V	Ω		
1		1	Shift gear to neutral. Ignition "OFF". Disconnect control unit and pump relay. Measure insulation resistance of engine-speed sensor. Term. 8 against term. 5	Greater than 1M Ω
2		2	Measure insulation resistance of reference-mark sensor. Term. 25 against term. 5	Greater than 1M Ω
3		3	Measure winding resistance of engine-speed sensor. Term 8 against term 27	0.6...1.6 k Ω
4		4	Measure winding resistance of reference-mark sensor. Term. 25 against term 26	0.6...1.6 k Ω
5		5	Measure resistance of engine temperature sensor (NTC II). Term. 13 against term 5	at 15° to 30°C: 1.45...3.3 k Ω (depends on temperature)
6		6	Measure resistance of air temperature sensor (NTC I). Term. 22 against term. 5	at 15° to 30°C: 1.3...3.6 k Ω (depends on temperature)
7		7	Measure resistance. Term. 10 against term. 5	Manual transmission: less than 15 Ω S/CH/AUS and Automatic: $\infty\Omega$
8		8	Deleted	
9		9	Accelerator in rest position. Measure resistance of idle contact. Term 2 against term. 5	Less than 15 Ω
10		10	Accelerator in full-load position. Measure resistance of full-load contact. Term. 3 against term. 5	Less than 15 Ω

L2

Rapid diag. ch. for univ. test adapter
BMW 6 and 7 series

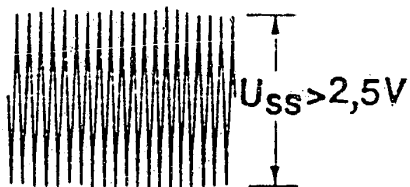
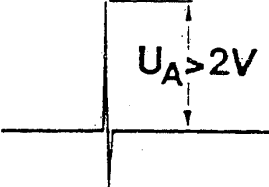
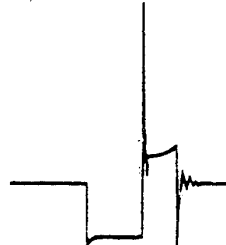


L3

Rapid diag. ch. for univ. test adapter
BMW 6 and 7 series



Rapid diagnosis chart for universal test adapter (continued)

<u>Test step</u>	<u>Switch position</u>		<u>Remarks</u>	<u>Test specifications (reading)</u>
	V	Ω		
11	↓	11	Measure resistance. Ground term. 16 against term. 5	<u>less than 10 Ω</u>
12	↓	12	Measure resistance. Ground term. 17 against term. 5	<u>less than 10 Ω</u>
13	↓	13	Measure resistance. Ground term. 19 against term. 5	<u>less than 10 Ω</u>
14/15	↓	14/15	Deleted	-----
16	1	15	Measure signal with oscilloscope. Engine-speed sensor term. 8 against term. 27. Shift gear to neutral and operate starting motor.	
17	2	15	Measure signal with oscilloscope. Reference-mark sensor term. 25 against term. 26. Shift gear to neutral and operate starting motor.	
18/19	3/4	15	Deleted	-----
20	6	15	Ignition "OFF". Connect control unit and pump relay. Ignition "ON". Measure voltage at main relay. Term. 35 against term. 5.	<u>10 ... 15 V</u>
21	7	15	Measure voltage at main relay. Term. 18 against term. 5.	<u>10 ... 15 V</u>
22	5	15	Measure ignition signal with oscilloscope. Shift gear to neutral and operate starting motor. Control unit, ignition output stage term. 1 against term. 5.	

L4

Rapid diag. chart f. univ. test adapter
BMW 6 and 7 series

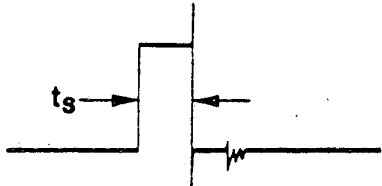
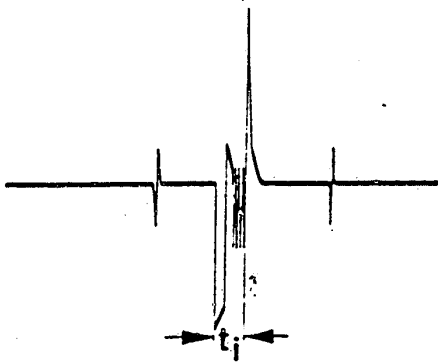
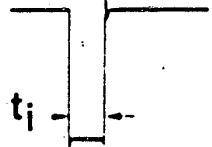


L5

Rapid diag. chart f. univ. test adapter
BMW 6 and 7 series



Rapid diagnosis chart for universal test adapter (continued)

<u>Test step</u>	<u>Switch position</u>		<u>But-ton</u>	<u>Remarks</u>	<u>Test specifications (reading)</u>
	V	Ω			
23	8	15		Measure voltage at control unit. Term. 9 against term. 5	<u>Greater than 7 V</u>
24	9	15		Measure voltage at air-flow sensor. Term. 7 against term. 5 <u>Air-flow sensor flap in rest position:</u> <u>Air-flow sensor flap open:</u>	<u>150...250 mV</u> <u>Greater than 7 V</u>
25 /26	10/11	15		Deleted	---
27	12	15		Measure voltage. Starting signal term. 50. Term 4 against term. 5	<u>8...15 V</u>
28	13	15		Test dwell-period signal t_s from control unit with oscilloscope. Term. 21 against term. 5 Shift gear to neutral and crank engine.	
29	14	15		Test injection signal t_i from control unit with oscilloscope. Term. 14 against term. 5. Shift gear to neutral and crank engine.	
30	14	15	T1	As 29, but duration of injection becomes slightly longer after pressing button (NTC II, cold).	
31	15	15		As test step 29, but term. 15 against term. 5	
32	16	15		Measure injection signal t_i from control unit with oscilloscope. Term. 11 against term. 5. Shift gear to neutral and crank engine.	

L6

Rapid diag. ch. for univ. test adapter
BMW 6 and 7 series



L7

Rapid diag. ch. for univ. test adapter
BMW 6 and 7 series



Rapid diagnosis chart for universal test adapter (continued)

<u>Test step</u>	<u>Switch Position</u>		<u>But-ton</u>	<u>Remarks</u>	<u>Test specifications (reading)</u>
	V	Ω			
33	17	15		Measure voltage at pump relay Term. 20 against Term. 5. Ignition on	<u>10 ... 15 V</u>
34	17	15		Measure voltage. Shift gear to neutral and crank engine. Control unit, active pump control. Term. 20 against Term. 5	<u>max. 4 V</u>
35	17	15	T 3	Ignition off. Connect pressure gauge. Ignition "ON". Press button T3. Read off fuel pressure.	<u>2.8 ... 3.2 bar</u> (S/CH/AUS: <u>2.3...2.7 bar</u>)
36	17	15		Connect motortester. Connect CO analyzer. Let engine run. Test idle speed and CO.	<u>750...850 min⁻¹</u>
	17	15	T 2	As above, readings unchanged.	<u>0.5 ... 1.5 % by vol. CO</u>
37	17	15		Let engine run. Test spark advance at idle speed. Important! Idle speed must be between 800 and 850 min ⁻¹ . Otherwise, different spark advance is indicated.	<u>5° ... 15°</u> (S/CH/AUS: <u>-5°...+5°</u> measure with diagnostic cable.
	17	15	T 6	Test spark advance at full load. Set engine speed to 2700 min ⁻¹ (S/CH/ AUS: 1600 min ⁻¹) and press T 6 (full-load button).	<u>23° ... 33° at 2700 min⁻¹</u> (S/CH/AUS: <u>18° ... 28° at 1600 min⁻¹</u>)
38	17	15		Dwell angle at idle speed	<u>6° ... 18°</u> (S/CH/AUS: <u>5°...15°</u>)
				Dwell angle at 3000 min ⁻¹	<u>22° ... 42°</u>
39	17	15	T 5	Hold engine speed constant at 2000 min ⁻¹ . Press button T 5. Injection signals stop and start again at approx. 1200 min ⁻¹ .	<u>Engine "hunts"</u>

L8

Rapid diag. ch. for univ. test adapter
BMW 6 and 7 series



L9

Rapid diag. ch. for univ. test adapter
BMW 6 and 7 series



1. Test specifications

<u>Idle speed</u>	<u>800...850 min⁻¹</u>
<u>Exhaust-gas setting:</u>	
CO concentration with engine at normal operating temperature	<u>0.5...1.0 % by vol. CO</u>
<u>Fuel pressure:</u>	<u>2.8...3.2 bar</u>
<u>S/CH/AUS:</u>	<u>2.3...2.7 bar</u>
<u>Fuel pump delivery:</u>	<u>min. 1050 cm³/30 s</u>

See equipment and autodata microfiches for settings for ignition, valve clearance and other engine data.

Solenoid-operated injection valve:

Electrical internal resistance	<u>2...3 Ω</u>
--------------------------------	----------------------------------

Air-flow sensor

Resistance value between terminals 6 and 7:	<u>8 Ω... 2500 Ω</u>
terminals 6 and 9:	<u>(air-flow sensor flap deflected) 500 Ω...1100 Ω</u>

Auxiliary-air device:

Electrical internal resistance:	<u>25 ... 60 Ω</u>
<u>S/CH/AUS:</u>	<u>35 ... 70 Ω</u>



Temperature sensor I (NTC I air):

Electrical internal resistance

at + 15°C ... +30°C: 1.45...3.3 k Ω

(measured at air-flow sensor
between term. 22 and term. 6).

At +80°C: 280 ... 360 Ω

Temperature sensor II (NTC II coolant):

Electrical internal resistance

at +15°C ... +30°C: 1.3...3.6 k Ω

at +80°C: 250...390 Ω

Engine-speed sensor and reference-mark sensor

Electrical internal resistance 0.6...1.6 k Ω

Throttle-valve switch (microswitch)

Resistance of idle contact

(term. 2 and term. 53): 0 Ω

Full-load contact

(term. 3 and term. 53): 0 Ω

Start valve

Electrical internal resistance: approx. 4 Ω

Thermo-time switch

Electrical internal resistance:

35°C/8s

"G" and
ground

"W" and
ground

"G" and
"W"

Ambient temp.
(below +30°C):

25...40 Ω

0 Ω

25...40 Ω

Engine at op.temp.
(above +40°C):

50...80 Ω

100...160 Ω

50...80 Ω

15°C/8s

(for S/CH/AUS):

Ambient temp.

(below +10°C):

50...70 Ω

0 Ω

50...70 Ω

Engine at op.temp.

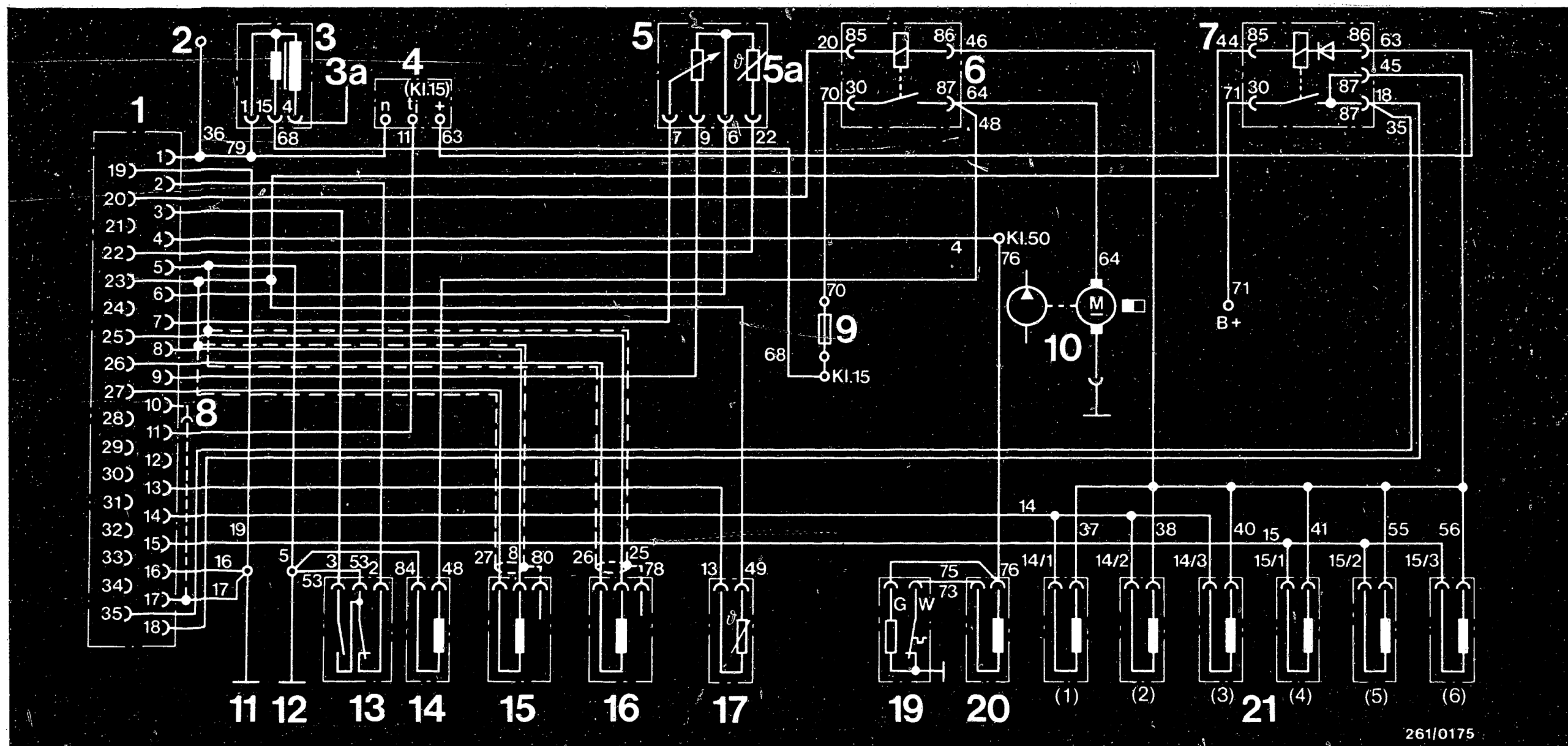
(above +20°C):

50...70 Ω

∞ Ω

∞ Ω





3. ELECTRICAL TERMINAL DIAGRAM - MOTRONIC

- 1 = Multiple plug to control unit
- 2 = To diagnostic plug
- 3 = Ignition coil
- 3a = To high-voltage distributor
- 4 = Plug to on-board computer
- 5 = Air-flow sensor
- 5a = Temperature sensor I (air)
- 6 = Relay 1 (pump relay)
- 7 = Relay 2 (main relay with reversed-polarity protection diode)

- 8 = Connection connected for manual transmission, disconnected for automatic. For S/CH/AUS see additional circuit diagram.
- 9 = Pump fuse
- 10 = Fuel pump
- 11 = Vehicle ground for control unit output stage
- 12 = Vehicle ground for control unit

- 13 = Throttle-valve switch (2 = idle contact, 3 = full-load contact)
- 14 = Auxiliary-air device
- 15 = Engine-speed sensor
- 16 = Reference-mark sensor
- 17 = Temperature sensor II (coolant)
- 19 = Thermo-time switch
- 20 = Start valve
- 21 = Injection valves

L12

Electrical terminal diagram
BMW 6 and 7 series

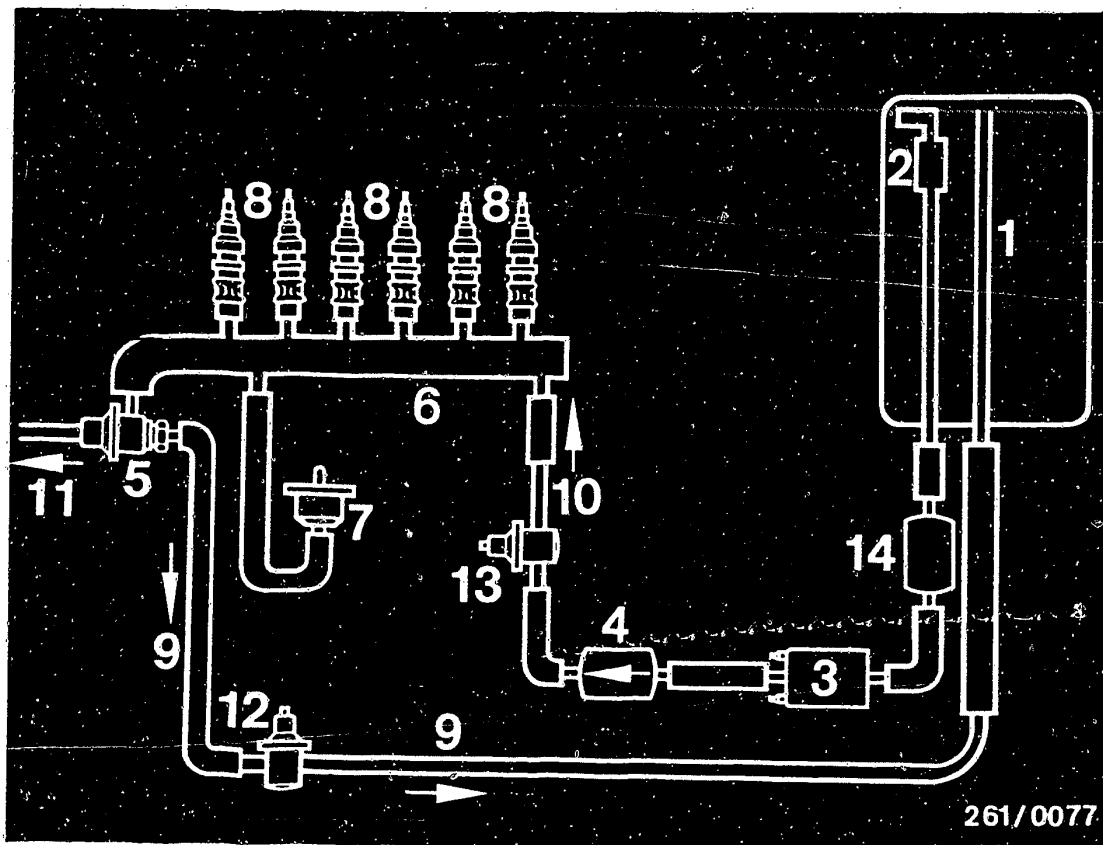


L13

Electrical terminal diagram
BMW 6 and 7 series



261/0175



4. Diagram of fuel lines

- 1 = Fuel tank
- 2 = Pre-supply pump (in tank)
- 3 = Electric fuel pump
- 4 = Fuel filter
- 5 = Pressure regulator
- 6 = Fuel-distribution pipe
- 7 = Start valve
- 8 = Solenoid-operated injection valves
- 9 = Fuel return line
- 10 = Fuel delivery line

The fuel delivery and return lines are routed on the left-hand underside of the vehicle.

- 11 = To intake manifold
- 12 = 1st fuel-line-pressure damper
- 13 = 2nd fuel-line-pressure damper
- 14 = Fuel spinner



5. Important general information

This information must be observed in order to prevent damage to the engine, control unit or ignition coil and for the safety of personnel.

5.1 Never start engine without securely connected battery.

5.2 Incorrect polarity of the supply voltage, e.g. by incorrect connection of the battery or ignition coil, can lead to irreparable damage to the control unit.

5.3 Do not use a fast charger for starting the engine.

Use only a second 12 V battery and jump leads.

Caution! Owing to different requirements of vehicle manufacturers with regard to electronic products we advise you not to use 24 V batteries as an aid for starting. Follow the vehicle owners manual.

5.4 Disconnect the battery from the vehicle electrical system before fast charging.

5.5 When charging the battery in the vehicle or when using a starting aid, follow the information in the operating instructions of the fast charger and also follow the information given by the vehicle manufacturer.

5.6 Never disconnect the battery from the vehicle electrical system with the engine running.

5.7 Do not short-circuit ignition coil term. 1 to ground (e.g. for stopping the engine). The ignition coil and possibly the control unit will suffer irreparable damage.



5.8 Never bring the positive pole of the battery into contact with ignition coil term. 1. The control unit will suffer irreparable damage.

5.9 Never connect or disconnect the wiring-harness plug of the control unit with the ignition switched on.

5.10 Remove the control unit at temperatures above 80°C (paint-drying installation).

5.11 Remove the control unit before performing welding work (electric spot welding).

5.12 When testing the compression disconnect the main relay. This prevents undesired injecting of the injection valves.

5.13 When installing an alarm system, follow the information given in the installation instructions for Motronic vehicles or follow technical bulletin "New Product" VDT-I-335/110 En.

It must be ensured that the alarm relay does not suffer interference from stray fields (e.g. from H.T. ignition cables), causing it to trip incorrectly.



6. SPECIAL EMISSION CONTROL SYSTEMS

for Sweden (S), Switzerland (CH) and Australia (AUS).

In compliance with the exhaust-emission regulations of these countries the concentration of carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NO_x) in the exhaust gas is reduced.

The systems include:

1. Fresh-air injection through self-operating air valves.
2. Exhaust-gas recirculation by means of EGR valve.
3. Map selection (2nd ignition and lambda map) in Motronic control unit.

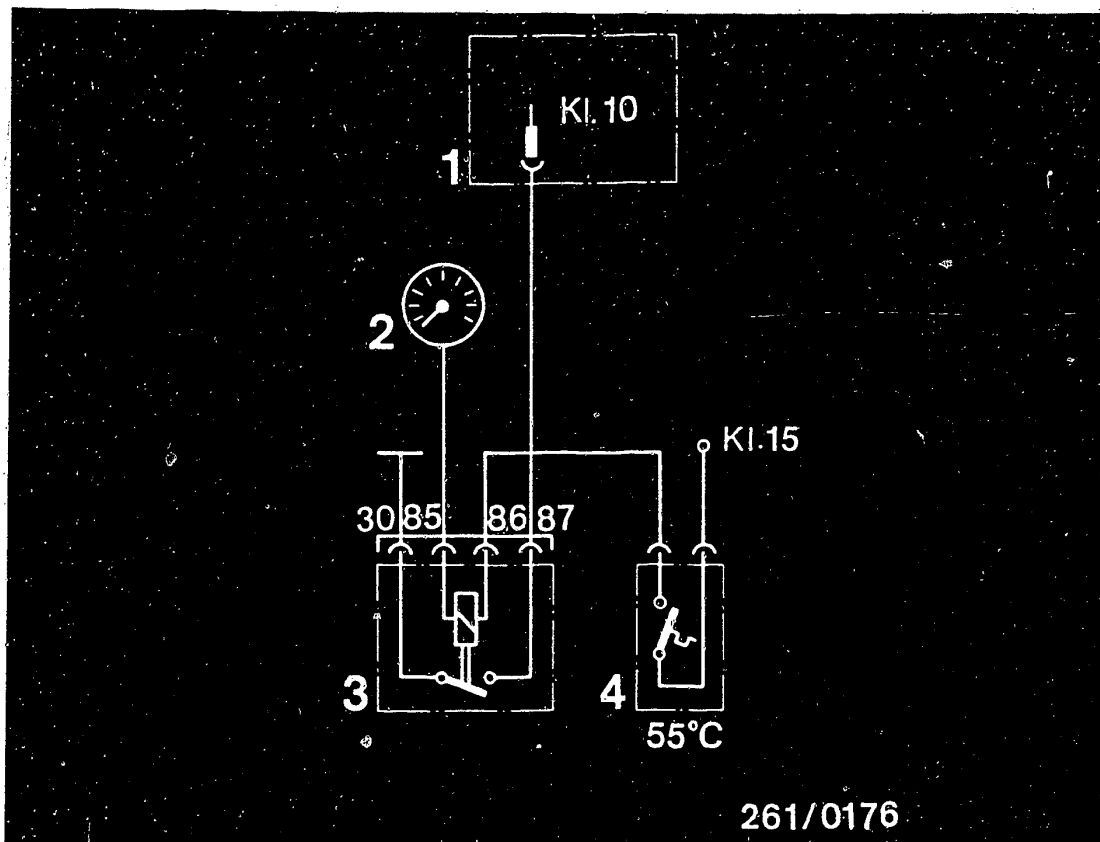
The self-operating air valves and map selection are used on all models.

The exhaust-gas recirculation (EGR) is necessary in conjunction with automatic transmissions.

Self-operating air valves

The valves add fresh air to the exhaust in the exhaust manifold in order to reduce the CO and HC concentrations to the permissible levels by means of after-burning. The operation of the air valves is based on the periodic vacuum occurring after the exhaust valves due to the pulsations in the exhaust pressure. With the aid of this vacuum the air valves automatically suck filtered intake air into the exhaust manifold and thus contribute toward reducing the emissions.



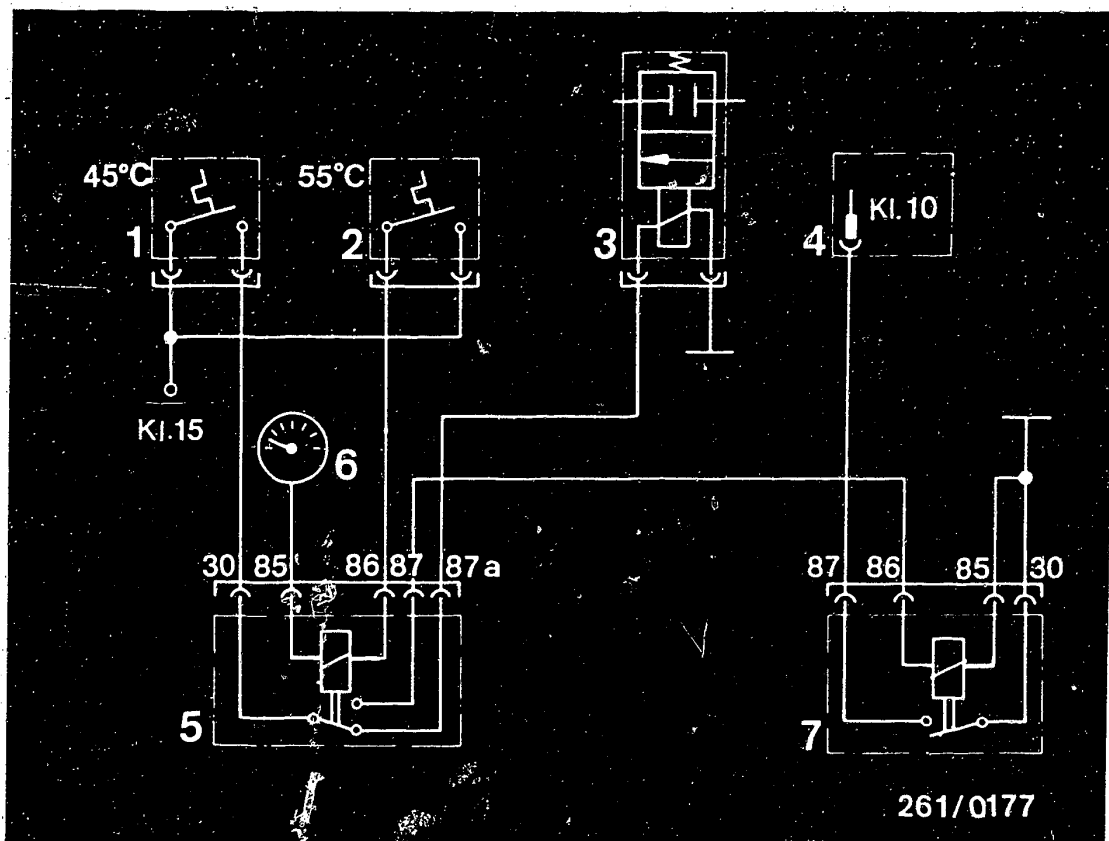


- 1 = Motronic control unit
- 2 = Speedometer
- 3 = Relay for map selection
- 4 = Thermo-switch +55°C

Emission control systems for vehicles with manually-shifted transmission

- Fresh-air injection with self-operating air valves.
- Spark-advance control through thermo-switch and road speed signal.

During the warm-up phase up to +75°C coolant temperature the spark advance is controlled by the 1st ignition map. As of +75°C and a road speed greater than 65 km/h there is a switch to the 2nd ignition map. Map selection is by connecting terminal 10 of the Motronic control unit to ground (term. 17).



- | | |
|---|-----------------------------|
| 1 = Thermo-switch +45°C | 6 = Speedometer |
| 2 = Thermo-switch +55°C ① | 7 = Relay for map selection |
| 3 = EGR valve | |
| 4 = Motronic control unit | |
| 5 = Relay for exhaust-gas recirculation | |

- ① Due to the poor transfer of heat between rubber hose and thermo-switch the water temperature at +75°C is well above the switching temperature (+55°C) of the thermo-switch.

Emission control systems for vehicles with automatic transmission

- Fresh-air injection
- Spark advance control through thermo-switch and road speed signal.



During the warm-up phase up to +75°C coolant temperature the spark advance is controlled by the 1st ignition map.

The switch to the 2nd ignition map is after the coolant temperature has reached +75°C and at a road speed above 65 km/h.

- Exhaust-gas recirculation through EGR valve.
As of +45°C coolant temperature the thermo-switch energizes the solenoid-operated valve through the change-over relay so that the vacuum can open the EGR valve.
As of +75°C coolant temperature there is exhaust-gas recirculation only if the road speed drops below 65 km/h.



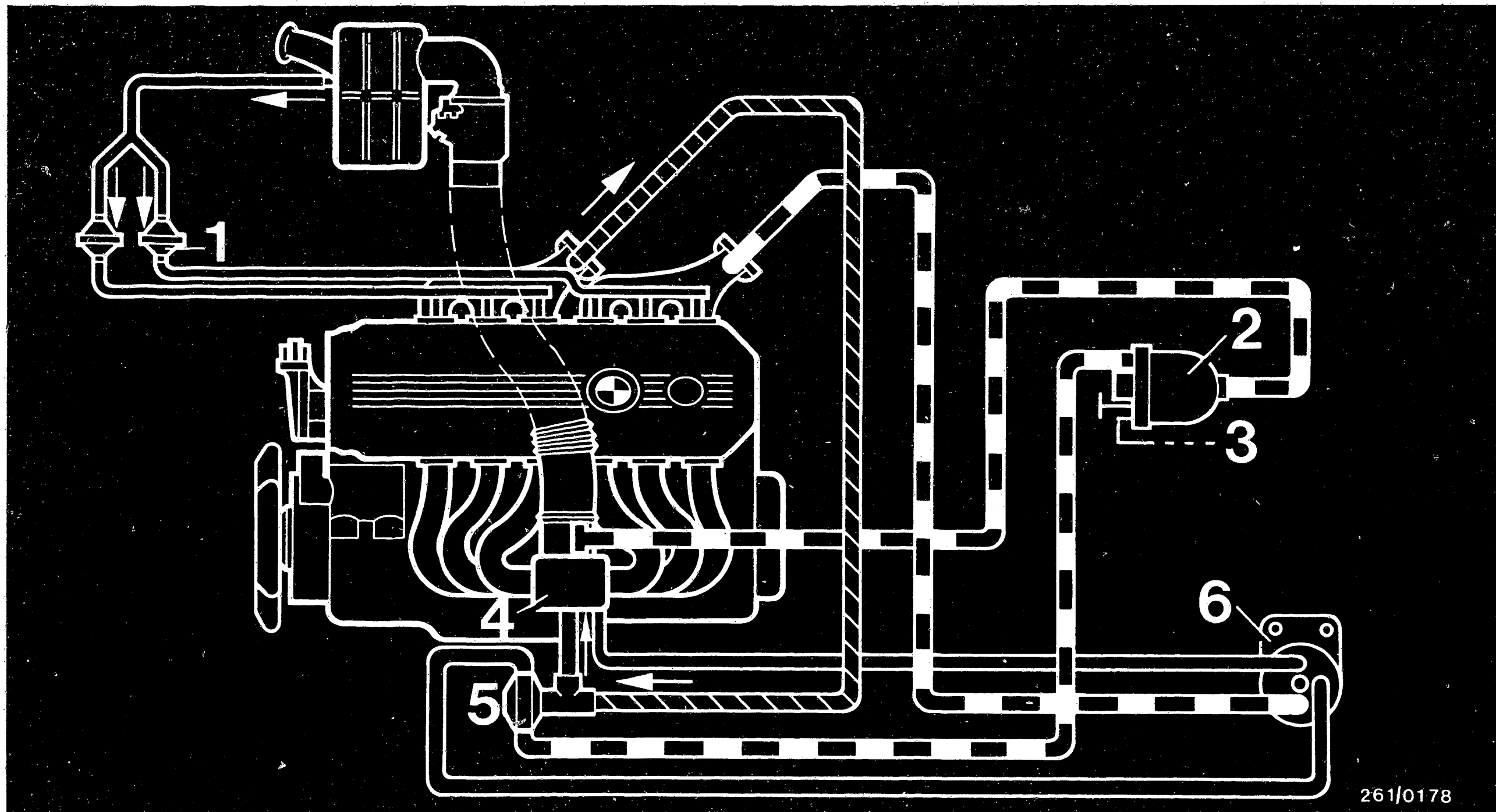


Diagram of lines of exhaust-gas recirculation system for BMW 633i A and 733i A (Sweden/Switzerland/Australia) with automatic transmission

1 = Self-operating air valves

2 = Solenoid-operated valve

3 = To relay for exhaust-gas recirculation

4 = Intake manifold

5 = EGR valve

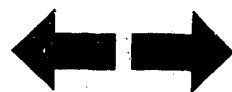
6 = Pressure converter

////= EGR line

---= Pneumatic control line

L21

Special emission control systems
BMW 633 CSI, 733i for S/CH/AUS



L22

Special emission control systems
BMW 633 CSI, 733i for S/CH/AUS



7. INSTALLATION POSITION OF COMPONENTS

The indications "right" and "left" always refer to the forward direction of travel.

Reference-mark and engine-speed sensors:	In starting-motor ring gear housing on circumference of flywheel ring gear.
Pressure regulator:	On fuel-distribution pipe in front of intake manifold.
Solenoid-operated injection valves:	On intake manifold.
Start valve:	On intake manifold under throttle-valve assembly.
High-voltage distributor:	Between intake manifold and radiator fan.
Fuel filter and fuel pump:	Under vehicle on left-hand side, near fuel tank.
Air-flow sensor:	Between air filter and intake manifold.
Relay 1 (fuel pump relay):	On fuse box.
Relay 2 (main relay):	In engine compartment on right-hand side on firewall.



Control unit:	<u>7 series:</u> Behind side panel in right-hand footwell <u>6 series:</u> In glove compartment.
Temperature sensor I:	In air-flow sensor.
Temperature sensor II (engine):	In front of intake manifold, near fan.
Thermo-time switch:	In front of intake manifold, near fan.
Central ground:	Under plug connectors for engine-speed and reference-mark sensors.
Auxiliary-air device:	Under throttle-valve assembly.



TABLE OF CONTENTS

Section

Coordinates

1. Test specifications	M 2
2. Prerequisites for testing	M 2
3. Rapid diagnostic chart	M 4
4. Electrical connection diagram	M 18
5. Installation position of the components	M 20
6. Test equipment and tools required ...	M 23



1. TEST SPECIFICATIONS

Due to considerations of safety, only the ABS-Tester is to be used for testing the ABS.

The rapid diagnostic chart contains all important test specifications and instructions for testing and troubleshooting.

2. PREREQUISITES FOR TESTING WITH ABS-TESTERS

- The tester must be retrofitted to the newest technical condition (built after FD 352, or identification "U2" on the nameplate).
- Make certain the ground connection of the return pump and the overvoltage protection relay Term. 31 are tight and free of corrosion.
- Check hydraulic connections and joints on the hydraulic assembly for leaks (visual inspection).
- If the ABS signal light lights from time to time during the trip (e.g., after users switch on) and goes back off on its own, check the battery and the electrical supply (alternator, regulator, and voltage drops).
- If the ABS signal light lights continuously, and does not go out, check the following points:
 - Is the multipole plug on the controller properly seated?
Did it catch?
Plug contacts O.K.?
Did the spring contacts catch?
 - Is the V-belt torn? (The alternator does not provide any electricity, the charge indicator light and the ABS signal light turn on).
 - Is there electricity from alternator Term. 61?
Are the plug connection and the lead to the ABS controller O.K.?
 - Be especially careful in checking for loose contacts for the wheel speed sensor in program switch setting 10.



- For testing with the tester, switch the ignition on in all settings of the program switch (the tester works with power supplied from the vehicle battery).
- Watch tester lights 1 and 2 in all settings of the program switch.

Caution!

Do not drive the vehicle with the tester connected to it!

After every repair, the entire test program is to be repeated.

General instructions for trouble-shooting

Check all leads for ground and contact to positive. Watch for wear and crimping.

- Connect the ABS-Tester to the controller and to the ABS wiring harness.

Caution!

Connect and disconnect the controller only when the ignition is off.

The controller is located behind the cover on the left of the steering wheel column.



3. RAPID DIAGNOSTIC CHART FOR THE ABS-TESTER

Switch on the ignition in all settings of the program switch.

<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification (Reading)</u>	<u>Cause of defect</u>
1...24	Electrical supply in every step of testing	-----	Light 1 (green) must turn on in every test step	<ul style="list-style-type: none"> ● Battery is not sufficiently charged. Repeat test step with engine running. ● Excessive voltage drops at the terminals (e.g., ground terminal). ● Overvoltage protection relay is defective. ● Break in the ground connection.
1	Valve relay - at rest	-----	Light 1 (green) and 3 (green) must turn on.	<ul style="list-style-type: none"> ● The leads (including the ground lead) to the valve relay have breaks, or too high a contact resistance. ● Valve relay is defective.
2	Valve relay - operation	-----	Light 1 (green) and 3 (green) must turn on.	
3	Return-pump relay at rest	-----	Light 1 (green) and 3 (green) must turn on.	<ul style="list-style-type: none"> ● Leads to the return-pump relay have breaks or too high a contact resistance. ● Return-pump relay is defective. ● Check the pump motor for continuity.
4	Return-pump relay operation	Press the illuminated button	Lights 1 (green) and 3 (green) must turn on, pump motor runs.	

M4

Rapid diagnostic chart

BMW 320i / 323i



M5

Rapid diagnostic chart.

BMW 320i / 323i



<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification (Reading)</u>	<u>Cause of defect</u>
5	Overvoltage protection relay (only built-in fuse and Zener diode)	Switch off ignition. Disconnect regulator device. Take the overvoltage protection relay out of the vehicle and plug in to the socket on the tester. Plug in new overvoltage protection relay into the vehicle. Turn on the ignition. Press the illuminated button.	Lights 1 (green) and 3 (green) must turn on.	<ul style="list-style-type: none"> The overvoltage protection relay in the socket on the tester is defective.
6	Internal resistances of the solenoid valves in the hydraulic modulator	Switch off the ignition. Connect the controller again. Turn on the ignition. Press button VL Press button VR Press button HA	Light 1 (green) must turn on. VL: 0.7...1.7 Ω VR: 0.7...1.7 Ω HA: 0.7...1.7 Ω	<ul style="list-style-type: none"> The leads to the valve in question have breaks or too high a contact resistance. The hydraulic modulator is defective.
7	Ground connection to Term. 10	Press the illuminated button	Light 1 (green) must turn on. 80 ... 300 mV	<ul style="list-style-type: none"> The ground connection and the ground terminal have a break or have too high a contact resistance.
8	Ground connection to Term. 34	Press the illuminated button	Light 1 (green) must turn on. 10 ... 250 mV	
9	Ground connection to Term. 20.	Press the illuminated button	Light 1 (green) must turn on. 10 ... 250 mV	



<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification</u>	<u>Cause of defect</u>
10	Internal resistances of the wheel speed sensors	Press button VL Press button VR Press button HL Press button HR	Light 1 (green) must stay lit. VL: 0.6 ... 1.6 kΩ VR: 0.6 ... 1.6 kΩ HL: 0.6 ... 1.6 kΩ HR: 0.6 ... 1.6 kΩ	<ul style="list-style-type: none"> • Check for loose contacts: Move all leads at the fastening points, at the plug and at the wheel speed sensors and watch the readings. • The leads to the wheel speed sensor in question have breaks or too high a contact resistance. • The wheel speed sensor in question is defective.
11	Insulation resistances of the wheel speed sensors	Press button VL Press button VR Press button HL Press button HR	Light 1 (green) must stay lit. VL: 20 ... 999 kΩ VR: 20 ... 999 kΩ HL: 20 ... 999 kΩ HR: 20 ... 999 kΩ	<ul style="list-style-type: none"> • Check leads to the wheel speed sensor in question for damage to the insulation. • Wheel speed sensor in question is defective.
12	DC voltage on the wheel speed sensor leads	Press button VL Press button VR Press button HL Press button HR	Light 1 (green) must stay lit. VL: 000 ... 100 mV VR: 000 ... 100 mV HL: 000 ... 100 mV HR: 000 ... 100 mV	<ul style="list-style-type: none"> • Check the leads to the wheel speed sensor in question for contact (wear location) to a plus-lead. • Wheel speed sensor in question is defective.
13	Internal power supply within controller	Press the illuminated button	4.75 ... 5.25 V	<ul style="list-style-type: none"> • Controller defective.



<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification</u>	<u>Cause of defect</u>
14	Diode in forward direction and ABS signal light		0.4 ... 1.5 V ABS signal light in the vehicle must turn on.	<ul style="list-style-type: none"> Leads to the diode and/or the signal light have breaks or contact resistance. Signal light is defective. Diode (hydraulic modulator) is defective.
15	Diode in the block direction		2.5 ... 8.5 V The ABS signal light lights somewhat more dimly.	<ul style="list-style-type: none"> Diode (hydraulic modulator) is defective.
16	Controller BITE* trigger	Press the illuminated button for 3 seconds	The signal light must go out after max. 1 sec.	<ul style="list-style-type: none"> Controller is defective
17	Controller, BITE* - simulation of defect	Press the illuminated button for 3 seconds	Signal light must stay lit (flickering allowable).	<ul style="list-style-type: none"> Controller is defective
18	Controller, current for maintaining pressure	Press button VL, Press illuminated butt. Press button VR, Press illuminated butt. Press button HA, Press illuminated butt.	VL: 1.9 ... 2.3 A VR: 1.9 ... 2.3 A HA: 1.9 ... 2.3 A	<ul style="list-style-type: none"> Controller is defective
19	Controller, current for dissipation of pressure	Press button VL Press illuminated butt. Press button VR Press illuminated butt. Press button HA Press illuminated butt.	VL: 4.5 ... 6.0 A VR: 4.5 ... 6.0 A HA: 4.5 ... 6.0 A	<ul style="list-style-type: none"> Controller is defective
24	Voltage from the brake light switch	Press brake pedal	10 ... 15 V	<ul style="list-style-type: none"> Lead to the brake light switch is defective. Brake light switch is defective. Brake lights are defective.

* BITE = Built-in testing circuit

M10

Rapid diagnostic chart

BMW 320i / 323i



M11

Rapid diagnostic chart

BMW 320i / 323i



For program switch settings 20, 21, 22, and 23; a brake testing stand (BPS) is required. Do not drive the vehicle with the tester connected to it! Do not use a brake pedal winch to adjust the braking force! Give absolute preference to program switch setting 23.

Front axle

Drive the vehicle with the front wheels on the brake test stand.

Put on the hand brake.

On vehicles with automatic transmissions, put the selector lever into "neutral".

<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification</u>	<u>Cause of defect</u>
23	Wheel speed sensor - signal	Press button VL, switch on brake roller at left Press button VR, switch off brake roller at left and switch on brake roller at right.	VL: 1.8 ... 19 VR: 1.8 ... 19	<ul style="list-style-type: none"> • Have the wheel speed sensors been exchanged, one for the other? • Air gap is too great. • The wheel speed sensor in question is defective.
20	Hydraulic modulator pressure reduction	Press button VR. Switch on the brake roller at right. Press the brake pedal and hold constant at <u>1500 N</u> . Press button VL. Switch off brake roller at right and switch on brake roller at left. Hold constant at <u>1500 N</u> with the brake pedal, press the illuminated button.	VR: 400 ... 1000 N VL: 400 ... 1000 N	<ul style="list-style-type: none"> • Have the brake lines been exchanged, one for the other? • Is the conventional brake system O.K.? • Hydraulic modulator is defective. <p><u>Note:</u> Take out and replace the complete hydraulic modulator only. No repair is permissible. Warning: Can be deadly!</p>
21	Hydraulic modulator pressure build-up	Press button VL, switch on both rollers. Activate brake pedal and hold constant at <u>1500N</u> . Press illuminated button.	Reading on the brake testing bench on the left drops to an intermediate value and then rises back to VL: 500...1000N	

M12

Rapid diagnostic chart
BMW 320i / 323i



M13

Rapid diagnostic chart
BMW 320i / 323i



<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification (Reading)</u>	<u>Cause of defect</u>
21	Hydraulic modulator pressure build-up	Press button VR. Switch on both brake rollers. Push brake pedal and hold constant at 1500 N. Press the illuminated button.	The reading for the brake testing stand on the right goes to an intermediate value and rises back to <u>VR: 500 ... 1000 N</u>	<ul style="list-style-type: none"> Have the brake lines been exchanged, one for the other? Is the conventional brake system O.K.? Hydraulic modulator is defective. Note: Take out and replace the complete hydraulic modulator only. No repairs are permissible. Warning: Can be deadly!
22	Hydraulic modulator pump delivery	Switch on brake rollers. Take reading for internal friction. Press button VA. Press brake pedal and hold constant at 1500 N. Press illuminated button.	After an intermediate value on both sides, the return pump switches on briefly. The reading on both sides must drop to less than the internal friction plus 200 N. The reading is displayed only for a short time!	<ul style="list-style-type: none"> The hydraulic modulator is defective. Note: Take and replace the complete hydraulic modulator only. No repairs are permissible. Warning! Can be deadly!

Rear axle: Drive the vehicle with the rear wheels on the brake test stand.

23	Wheel speed sensor - signal	Press button HL, switch on brake roller at left. Press button HR, switch off brake roller at left, switch on brake roller at right.	<u>HL: 1.8 ... 19</u> <u>HR: 1.8 ... 19</u>	<ul style="list-style-type: none"> Have the wheel speed sensors been exchanged, one for the other? Air gap too large. Wheel speed sensor in question is defective.
----	-----------------------------	---	--	---

M14

Rapid diagnostic chart

BMW 320i / 323i



M15

Rapid diagnostic chart

BMW 320i / 323i



<u>Program switch setting</u>	<u>Object tested</u>	<u>Additional procedure</u>	<u>Test specification (Reading)</u>	<u>Cause of defect</u>
20	Hydraulic modulator pressure reduction	Press button HA. Switch on both brake rollers. Press brake pedal and hold constant at <u>1500 N</u> . Press illuminated button.	<u>HA: 400...1000 N</u>	<ul style="list-style-type: none"> • Have the brake lines been exchanged, one for the other? • Is the conventional brake system O.K.? • Hydraulic modulator is defective. <p><u>Note:</u> Take out and replace the complete hydraulic modulator only. No repairs are permissible. Warning: Can be deadly!</p>
21	Hydraulic modulator pressure build-up	Press button HA, switch on both brake rollers. Press brake pedal and hold constant at <u>1500 N</u> . Press illuminated button.	<u>Reading for the brake test stand on both sides goes to an intermediate value and rises again to HA: 500 ... 1000 N</u>	<ul style="list-style-type: none"> • Hydraulic modulator is defective. <p><u>Note:</u> Take out and replace the complete hydraulic modulator only. No repairs are permissible. Warning: Can be deadly!</p>
22	Hydraulic modulator pump delivery	Switch on brake rollers. Take reading for internal friction. Press button HA. Press brake pedal and hold constant at <u>1500 N</u>	<p>After an intermediate value on both sides, the return pump switches on briefly. The reading on both sides must drop to a value below the <u>internal friction plus 200 N</u>. The reading is displayed only for a brief time!</p>	<ul style="list-style-type: none"> • Hydraulic modulator is defective. <p><u>Note:</u> Take out and replace the complete hydraulic modulator only. No repairs are permissible. Warning: Can be deadly!</p>

As a final test, do a test drive.

With the engine running, the signal light must go off.

Drive at least 30 km/h.

It is not permissible for the signal light to light up again when that is done.

M16

Rapid diagnostic chart

BMW 320i / 323i

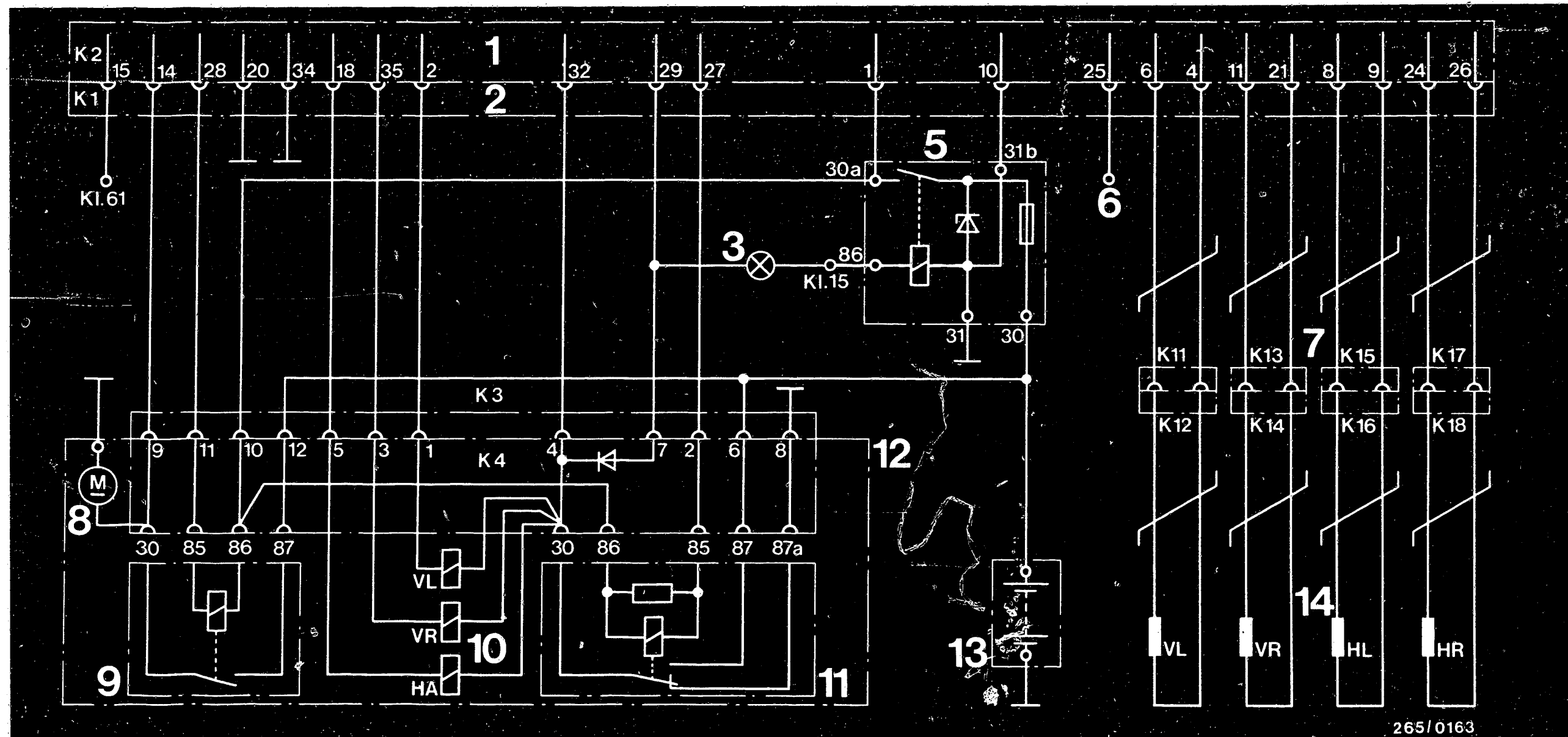


M17

Rapid diagnostic chart

BMW 320i / 323i





265/0163

- 1 = Electronic controller
- 2 = Multiple plug (35-pole)
- 3 = ABS signal light
- 5 = Overvoltage protection relay
- 6 = To the brake light switch (+)
- 7 = Lead connector
- 8 = Return pump motor

- 9 = Return-pump relay
- 10 = Solenoid valves
- 11 = Valve relay
- 12 = Hydraulic modulator
- 13 = Battery
- 14 = wheel speed sensors

- VL = Left front
- VR = Right front
- HA = Rear axle
- HL = Left rear
- HR = Right rear
- K1 to K18 = ABS plug connections

4. ELECTRICAL CONNECTION DIAGRAM

M18

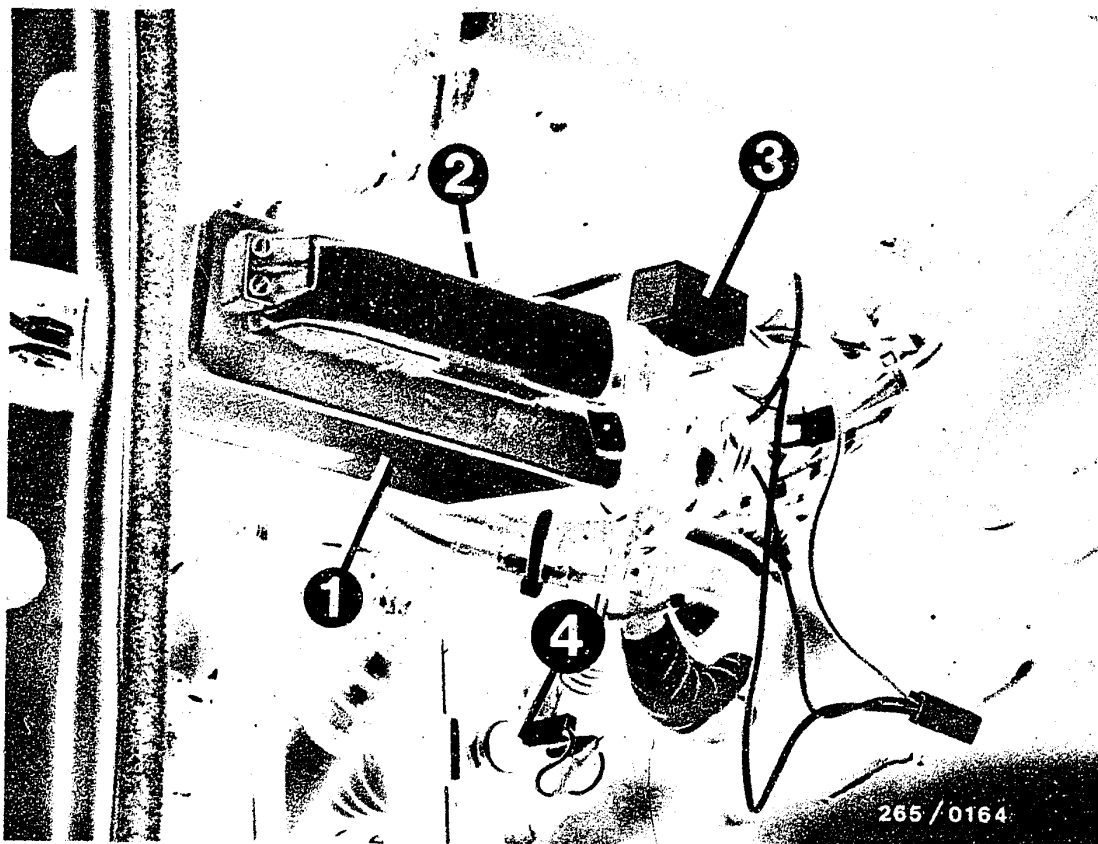
Electrical connection diagram
BMW 320i / 323i



M19

Electrical connection diagram
BMW 320i / 323i





5. INSTALLATION POSITION OF THE COMPONENTS

Indications for installation position are always given looking in the direction of forward vehicle travel.

- 1 = Controller:
Behind the cover to the left of the steering column.
- 2 = Ground terminal for the ABS:
To the right of the controller.
- 3 = Overvoltage protection relay:
To the right of the controller.
- 4 = Brake light switch:
At the brake pedal.
- ABS signal light:
In the dashboard.





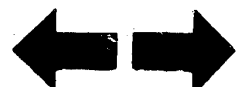
Arrow = Wheel speed sensor, left front,
 Make certain that the wheel speed sensors for
 the front wheels on the left and right are not
 exchanged for one another on installation.
 The air gap becomes too great and the signal
 too small!

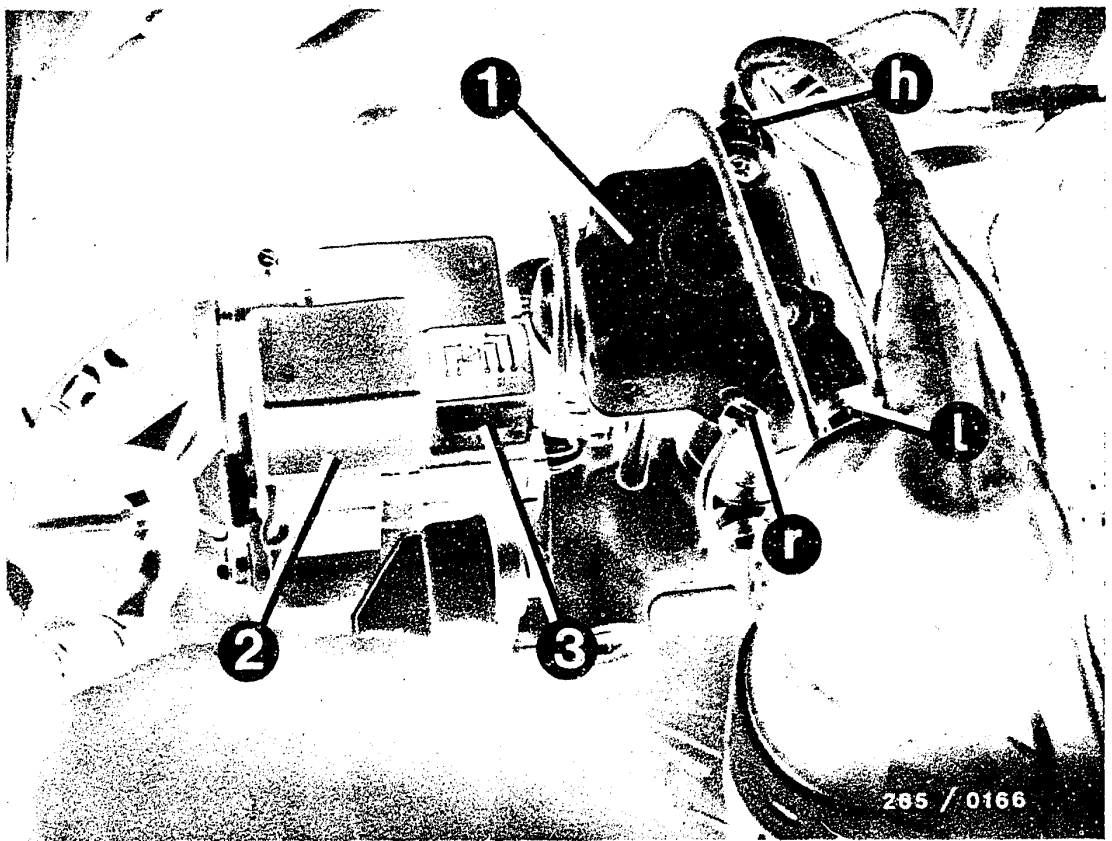
- Wheel speed sensors, front axle:

One each in the steering knuckles on the left and the right.

- Wheel speed sensors, rear axle:

One each on the left and right near the disc brake calipers.





1 = Hydraulic modulator:

In the engine compartment, behind the headlight on the left.

l = Brake line to the left front wheel brake cylinder

r = Brake line to the right front wheel brake cylinder

h = Brake line to the wheel brake cylinders on the rear wheels

2 = Return-pump relay

3 = Valve relay

The hydraulic modulator must not be repaired. It must be taken out and replaced as a complete unit only.

Exception: Replacement of relays.



6. TEST EQUIPMENT AND TOOLS

Name	Designation	Part number
<u>ABS-Tester</u> Use only retrofitted testers! Built after FD 352 or with identification "U2" on the nameplate	ETT 016.00	0 684 101 600
<u>Adapter cable</u> For connection of the overvoltage protection relay		1 684 460 120
<u>Brake test stand</u>	e.g. BPS 100 or BPS 101 or BPS 104 or BPS 105	0 680 012 .. 0 680 013 .. 0 680 018 .. 0 680 019 ..
<u>Filling and bleeding machine</u>		e.g. ATE Part No. 3.9302-1000.4 1)
<u>Bleeder tube fitting</u> to connect the filling and bleeding machine to the compensating reservoir of the main cylinder		ATE Part No. 3.9302-0702.2 1)
<u>Bleeder hose</u>		ATE Part No. 3.3590.2300.1 1)
<u>Additional hose</u>		ATE Part No. 3.9302.0704.2 1)
<u>Brake pedal winch</u>		ATE Part No. 3.9312.0100.4 1)

1) Obtain from: Alfred Teves GmbH
 Guerickestrasse 7
 D 6000 Frankfurt/Main



Name	Designation	Part number
<u>Pressure tester</u> Tester for low and high pressure testing of hydraulic brake systems		e.g. ATE Part No. 3.9305-0200.4 1)
<u>Double box wrench</u> open 9 x 11 mm		Hazet Part No. 612 2)
<u>Vessel</u> to catch the brake fluid, approx. 1 l <u>Brake fluid:</u> BMW-DOT 4 or ATE SL-DOT 4 or Veedol Disc Brake Fluid DOT 4 or Castrol Disc Brake Fluid DOT 4		
<u>Electric-tester</u> or <u>multi-tester</u> for trouble-shooting	ETE 014.00	0 684 101 400 Commercially available

6.1 Auxiliary material

Use only original brake lines from BMW!

Designation	Part number
Grease for wheel speed sensors	Molykote Longterm 2
Safety cap for brake lines	1 900 508 002 (100 pc.)
Protective caps for connections of brake lines to the hydraulic modulator	1 900 508 004 (100 pc.)

1) Obtain from: Alfred Teves GmbH, Guerickestrasse 7
D 6000 Frankfurt/Main

2) Firma Hazet, D 5630 Remscheid

M24

Test equipment and tools

BMW 320i / 323i

